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ASIATIC SOCIETY OF BENGAL

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PART I. (HISTORY, ANTIQUITIES, &C.).

(Nos. I AND II.—1900.)

EDITED BY THE  
HONORARY PHILOLOGICAL SECRETARY.

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“It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.” SIR WM. JONES.

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Under orders of the Council the following system of transliteration will be adopted for the future in all publications of the Society. Authors of papers for the *Journal*, Pt. I, are particularly requested to adhere to it in their contributions.

**A. FOR THE DĒVANĀGARĪ ALPHABET, AND FOR ALL ALPHABETS RELATED TO IT.**

अ a,	आ ā,	इ i,	ई ī,	उ u,	ऊ ū,	ए e,	ओ o,	ऐ ai,	औ au,	ं ṁ,	ः ḥ
क k,	ख kh,	ग g,	घ gh,	ङ ṅ							
च c,	छ ch,	ज j,	झ jh,	ञ ñ							
ट t,	ठ th,	ड d,	ढ dh,	ण n							
त t,	थ th,	द d,	ध dh,	न n							
प p,	फ ph,	ब b,	भ bh,	म m							
य y,	र r,	ल l,	व v,	(ळ ḷ)							
श ṣ,	ष ṣ,	स s,	ह h.								

In the above the *virāma* has been omitted for the sake of clearness.

In Modern Vernaculars only; ष may be represented by r, and ह by rh.

*Avagraha* is to be represented by an apostrophe, thus सो ऽपि sō 'pi. *Visarga* is represented by ḥ, *Jihvāmūliya* by ḷ, and *Upadhmaniya* by ḥ. *Anusvāra* is represented by ṁ, thus संसर्गे saṁsarga, and *anunāsika* by the sign ~ over the letter nasalized, thus अँ ā̃, आँ ā̃, and so on. The *udātta* accent is represented by the sign ' and the *svarita* by ^ . Thus, अग्निः agnih, जनिता janitā, क्व क्वी kvd, कन्या kanyā. The *anudātta* accent may be represented by ` . Thus, ते अवर्धन्ते tē àvardhanta.

**B. FOR PERSIAN (INCLUDING ARABIC WORDS IN PERSIAN) AND HINDŪSTĀNĪ.**

(The system is not applicable to Arabic when pronounced as in Arabic-speaking countries) :—

Vowels.	Consonants.	Sounds only found in Hindūstānī.
ا a	ب b	ب bh
آ ā	پ p	پ ph
ا i	ت t	ت th
ای ī		ت t
آ ē		ث th
ا u	ج j	
او ū	ح c	ح ch
و o	ع c	

Vowels.	Consonants.	Sounds only found in Hindūstānī.
ای ai	ح h	
او au	خ <u>kh</u>	
	د d	د dh
		ڈ ḍ
		ڈ̣ dḥ
	ذ z	
	ر r	ر ʀ
		ر̣ ʀ̣
	ز z	
	ژ <u>zh</u>	
	س s	
	ش <u>sh</u>	
	ط t	
	ظ z	
	ع e	
	غ <u>gh</u>	
	ف f	
	ق q	
	ک k	ک kh
	گ g	گ gh
	ل l	
	م m	
	ن n	
	و when representing <i>anunāsika</i> in Dēva Nāgarī, by ~ on the preceding vowel	
	و w (or rarely v)	
	ه h	
	ی y	
	Hamzah ʾ (where necessary)'	

The *ʾ* of the article *ال* in Arabic words should be assimilated before the solar letters; and the vowel *u* which often precedes the article and absorbs its vowel should remain attached to the word to which it belongs. Thus—اقبال الدولة Iqbāl-u-d-daulah.

*Tanwīn* may be rendered by *n*—e. g., *ittiṭṭāqan*. *Alif-i maqṣūrah* should be rendered by *ā*.

Final *z* need not be written in Persian and Hindūstānī words, but should be written in Arabic words.

# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



Part I.—HISTORY, LITERATURE, &c.

No. I.—1900.

*Jangnāmah of Farrukhsiyar and Jahāndār Shāh, a Hindī poem by Çrīdhar (Murlīdhar) Brahman, of Prāg.—By WILLIAM IRVINE, late of the Bengal Civil Service.*

[Read April, 1899.]

The following long poem of 1630 lines, on the above subject, was lately traced for me by Maulvi 'Abdu-l-'aziz of Bhitri, through a native of the same place now resident in Benares, Bābū Rādhā Kiṣṇ Dās. It was found in the library of the late Bābū Hariṣ Cand of Maḥallah Caukhambah in the city of Benares. For this gentleman see No. 581 of Grierson's "Modern Vernacular Literature of Hindūstān," (1889). After four months' efforts permission to make a copy was obtained through the influence of C. L. M. Eales, Esq., C.S., District and Sessions Judge, to whom I am much indebted. A Hindī copy was made for me by the Judge's Registration Muharrir in his leisure hours, and one in the Persian character by M. 'Abdu-l-'aziz.

The work is so long as to debar its reproduction in full, nor is it throughout of equal interest. While he is expatiating at more or less length on the heroic virtues of the nobles and officers who have gathered round Farrukhsiyar's standard, the poet allows his narrative to stand still; and as a consequence, in spite of the copious vocabulary at his command, he repeats himself considerably, and the epithets soon begin to recur with "damnable iteration." I therefore propose to submit to

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the Society no more than extracts (680 lines in all) giving the narrative, and including at least one specimen of each kind of verse. For the rest I append an alphabetical index of the persons, tribes and places introduced.

There are a few, though not many, unhistorical statements. For instance, (lines 31, 32.) 'Abdullāh Khān is made out to have been at Paṭnah when he was really at Allāhābād; in lines 39-42 Mir Jumlah's asserted opposition to Jahāndār Shāh is pure myth; and the dates in lines 883-886 are hopelessly wrong. On the other hand, some of the details as to localities add to our previous knowledge, and the copious use of actual names shows, to my mind, that the author either was present in the army or wrote immediately afterwards.

In several instances the introduction of tribal names is not only ingenious but effective. Here is one example :

1. 1133. *Rajpūt sohāe sāje āe, Hāqā, Gaur, Sombaṁsī*  
*Caumhān, Camdenle, Bais, Baghele, Gaharwār au Raghubaṁsī*  
*Kachwāha, Sulāṁki, Haihayabaṁsī, Sīrnete, Parihāraṁsī,*  
*Gaṁdharb Sīṁh Rājā saṁyo, dal, Bumlele, Sūrajbaṁsī.*

The kinds of verse used are thirteen in number and are as follows, stated in their order of frequency. *Kabit*, lines 1109-1248, 1465-1576, 1579-1630 (304 lines), *Bilās Chand*, 895-1108 (214), *Pādāṅkul Chand* 171-376 (206), *Gītā Chand*, 695-894 (200), *Hārī Gītā Chand*, 1309-1464 (156) *Madhubhār Chand*, 423-548 (126), *Doharā*, 1-20, 39-70, 389-422, 637-656 (108), *Harī Gītā*, 71-170 (100), *Bhujang Prayāt Chand*, 549-636, (88), *Hīrā Chand*, 1249-1308 (60), *Ardhik Chand*, 657-694 (38), *Tomar Chand*, 21-38 (18) *Chappai Chand*, 377-388, (12), total 1630 lines. As there seems some irregularity or oversight in the numbering of the stanzas, I have substituted an enumeration by lines.

On the evidence of the work now brought forward, two emendations may be suggested in the work by Mr. Grierson above referred to. First, the entries No. 156 (Murlidhar) and No. 157 (Çridhar) on p. 65 may be united into one of Çridhar *alias* Murlidhar. Secondly, the date assigned to him, 1688 A.D., may be made at least thirty years later, for the present work, at the very earliest, belongs to 1713 A.D.

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In the pursuit of meanings, sometimes hard to catch, I have treated the poet's spelling with scant respect, making aspirated and unaspirated, dental and cerebral letters, *l*'s and *r*'s, freely interchangeable. I have, in fact, chosen "whatever suits the line."

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Since I began this paper, I have received a second poem by the same poet, a sort of supplement or continuation of the *Jang-nāmah*. It is on 133 folios, and at a rough computation reaches 3560 lines in length. As it is made up of nothing but laudatory stanzas on various nobles, I shall content myself with stating the headings into which it is divided:—

fol. 1a.	Ratan Cand ke Kabita	verses	15
3b.	Rāo Ras ke Kabita, Phulwāri barnan,	„	9
5a.	Kabita Bahādūr Ji ke, Phāg barnan	„	12
9b.	Māhārājā Chabile Rām ke Kabita	„	18
11a.	Mir Muṣhrif ke Kabita	„	11
13a.	Rājā Jaswant ke Kabita	„	5
16a.	Kabita Sher Muḥammad	„	30
20b.	Kabita Mahārājā Chabile Rām ke }	„	36
26b.	Quṭb-ul-mulk Ḥasan ‘Ali Khān }		
27b.	Ḥusain ‘Ali Khān ke Kabita	„	43
48	[No heading]	„	167
71b.	Kabita Muṣliḥ Khān ke	„	100
82	[No heading]	„	100
95a.	[Doharā—No heading]	„	88
104a.	Ḷri Rām Ji	„	100
116a.	[No heading]	„	51
123a.	[No heading—Stanzas 37-52 wanting]	„	84
132b.	[No heading]	„	2
Total verses			871

After looking through this portentous production, one feels appalled at the enormous facility with which Hindī verse can be written.

## दोहरा ।

- 5      ओधर सुरलौधर उरफ दिजवर वसत प्रयाग ।  
 बधिर कथा यह शाहि की बखी कथन अनुराग ॥  
 फरकसियर से शाहि को वरगो प्रबल प्रबंध ।  
 अब करतूतै सवन की जे अमीर समकंध ॥  
 चौठी बली महाजनी भई एका एक चाह ।
- 10     झाड़ि देहें सुरलोक को गय बहादुर शाह ॥

- सुनो भवरि एकवारगो फरकसियर उदार ।  
 राबि मौज एकलगारहीं चलिये यहै बिचार ॥  
 बकसी आजम खान को कौन्दो ऊकुम बोलाइ ।  
 मौज राबिये जाय अब जेती राबी जाइ ॥  
 15 फेरि भवरि दिन दसक में सांचो पऊचो व्याइ ।  
 जुलुफिकार उमराउ सब मिले मौजदिहि जाइ ॥  
 जुलुफिकार भां फोरि सब मौज दगा किय संग ।  
 नातरु वैसे वलिकु सो को जीतत सफ जंग ॥  
 मौजदीन सिर छत्र धरौ कुतुवा कुटिल पठाइ ।  
 20 चढ्यो दिल्ली को चऊं दिसां लिबि परमाण पढ़ाइ ॥

### तोमर छंद ।

- यह भवरि पऊंचा तथ्य  
 तब फरकसियर समथ्य  
 सिगरे बोलाइ अमौर  
 सब सो छपा करि बीर  
 25 सब सो दियो परमाइ  
 अब मौज रामऊ जाइ  
 यह ऊकुम करि सुभ वधुत  
 धरि छत्र वैठो तथुत  
 सब शाहि के दिलसोज  
 30 तब लगे रामन मौज  
 सजि अबदुल्लाह बान  
 किय प्रथम कोपि पाथान  
 ऊव शाहि को इरशाद  
 पऊंचो इलाहावाद  
 35 सूवा व मै सरकार  
 सब किषो अमल उदार  
 रनवां कुरावल वान  
 करि रछ्यो कायम थान ॥

## दोहरा ।

- तह मीर जुमिना बीर बुद्धि गंभीर बाऊ विसाल ।  
 40 मड़ि रङ्गो मौजूद्दीन की कटक गहि करवाल ।  
 सूवा सवै मनसूव वाजवि डारी घाल ।  
 अरु ग्राहि को सिंगरी हकीकति लिखत तब तत काल ।  
 तब मीर जुमिना बीर अरज लिख्यो सुपत्र उदार  
 इन सैद राजे घान कीनो प्राग सूवेदार  
 45 वह बल्यो साजि हिरौल अगे सैद अबुलगाफार  
 पीछे पठायो महादलु दै एजदीन कुमार ॥  
 यह मीर जुमिना बीर सब अरज पङ्गो तथ्य  
 ग्राहनग्राह जहां पनाह सु फरकसियर समथ्य  
 सुनिके अमीरन ओर हेरो कोपि कै समरथ्य  
 50 बोल्यो हुसेन अलीय खां रनवां कुरा गजहत्य ॥  
 एकबाल ग्राहनग्राह को इस में न आन को आन  
 उन को अकेलोवै सैयद अबदुल्लाह घान  
 तिन को क्रिया करि वेग सो लिख भेजियो फरमान  
 वह मारि फौज विदारि दल रज मारि है घमग्रान ।  
 55 ग्राहनग्राह लिख्यो जवे फरमान पङ्गो आइ  
 तव सैद अबदुल्लाह घां लीगो सुअदव वजाइ  
 वह ऊकम सिर धरि दै नगारो सु मिरि प्रभु को पाइ  
 डेरं सु आलल चंद करि अरि राह रोक्यो जाइ ॥  
 फुनि आपु स्थिर करि रङ्गो घानो गङ्गो प्राग करार  
 60 भाई पठयो जंग को सब संग दै सरदार  
 सै सुव सख्यो सैफुदी अली घां वंक वीर उदार  
 साख्यो निजामुद्दी अली घां कोपि गहि कर तरवार ॥  
 साख्यो सिराजुदी अली घां वीर वलवान  
 फिरि सख्यो राजा रतन चंद गबंद गहि किरवान

- 65 फिरि मीर मुहसन बाब साज्यो वीर अगवर बाब  
 साज्यो समुदर खान अर इदगार वेग जवान ॥  
 मीरजा वली वहराम वेग चद्यो गहे कर चाप  
 जेहि वाप वरकांदाज बां सु किताव पायो व्याप  
 अर सज्यो त्यो दरवेशली बां सैद वीरत क्वाप  
 70 साने वली सरदार केते सतु दारग दाप ॥

### हरिगीत ।

- इत अरे आलम चंद उत कोहजन देरा कियो  
 भिगसार होत दुहं दिसा दुहं दलपती डंका दियो  
 इत ए चढ़े उत वे वड़े मग बड़े दुहं वागैं लियो  
 दल भार सों विकरार महि रजधान सूरजो पियो ॥  
 75 तव मयो देखादेष दुहं दल दुहं दल चापैं चढ़ी  
 वाणी वंदूषै रहकले हथगाल घूम घटा मढ़ी  
 तव वीशु चमकनि भमकि त्यो समसेर न्याननिंते कढ़ी  
 जागा भूराभर गानु गटपट बधिर कौ सलिता बढ़ी ॥  
 ललकारि हांक निदंत सावंत दपट दुहं दल धावहीं  
 80 गरवी मगरवी कर गहे भुंकि भूपटि चोट चलावहीं  
 छिन जात धाई उठाइ एछिन अटल अरि वरचावहीं  
 द्वि पहर उसला पसल भटरग सिंधु पारग पावहीं ॥  
 × × × × × ×  
 99 यह वारहै के बालकनि को लषो अति गाढ़ो हियो  
 100 सैबद सिराजुही अनी बां तव सहादति कों लियो  
 हरबंत हरनि हाथ को पुर प्रेस सो प्याला पियो  
 करि हाल निमकहलाल ओप सिपाह सूरनि को दियो ॥  
 यह सोर भो चहं और ते दौरे सवे सरदारहैं  
 तित डारि टालैं टारि कूटैं फारि जिरह अगारहैं

- 105 अब छोरि वषतर तोरि ब्यागनि गङ्गो करनि कटारहैं  
 घमके चङ्ग नेजामुनै भूमके घनी करवारहैं ।  
 इमि दौरके चङ्ग छोर ते पर फौज घेरी जाबके  
 तहं तोर वरछा वाम गोली अंग अंग रअंगाइ के  
 समसेर वार भराभरौ कर कर कटारनि घाइ के
- 110 भुकि भूपटि भुरमुट बेनि अरि दल दियो महिवि थराथके ।  
 कोटै कितै भूमे परे कोऊ घाइ सो घूमे घरे  
 कोउ भये मुरछावंत डर सो ते विना मारे मरे  
 सरदार अबदुल्लाफार के अंग अंग घन घाएनि मरे  
 रन भूमि में पायो नहीं जावै कहां किहिं लै धरे ।
- 115 इमि कूटि भटकनि कटक लूटन जगे दरवर वैदरा  
 जिहि पाय में पनही नहीं मै खार ते ऊपैदरा  
 वाजे जसौ ले शाहनामे घमक सो घमके धरा  
 परमै फतूहनि लै फिरे जस जग्यो सावंत सैदरा ।  
 कुतुबुलुमुलुक सों तव मिजा मंजूर अरज सवै कियो
- 120 वाजे नगारे गहगहे आनंद सो हरथो हियो  
 सुनिकै सिराजुहीं अली घां की दसा गुस्सा पियो  
 आवै करेरी एठि मोहनि दांत ओठनि में दियो ।  
 वोले सु अबदुल्लाह घां अब मै महारन माडि हों  
 सिगरी पछांहीं फौज को कर कर कटारनि कांडि हों
- 125 आए जेते सरदार कै तेहि प्राण डांडनि डांडि हों  
 सब सो सिराजुही अली घां कै वीअर लेकै कांडि हों ।  
 रनघेत में कुबघेत सों तरवारि मार मचाइ हों  
 मुजजोर तें परबोर के सब जोवते गहिल्याइ हों  
 तव शाहि फरकसियर को वंदा वनैत कहाइ हों
- 130 [ Line wanting in original ] ।

× × . × × × ×

- 189 दिन और कुतुबुलुमुलुक बोले बोले साहेब राय सो  
 140 लिखि अरज ग्राहन ग्राह को सब भेद बात वनाए सो  
 भई ऊसेन अली बां को लिखो सब समझाए सो  
 जिहिं आइ ह्यां एलगार पऊचे साज फौज उपाए सो ॥  
 सुनि लिख्यो साहेब राय माथुर अरज पत्र तहां तवे  
 सप्त जंग की सब बात जैसी भई जौन जहां जवे  
 145 पटनि पछाहीं फौज की आदम अमीरन की  
 औ फिर लिखो ऊसेन अलीय बां जू कों सवै ॥  
 × × × × × ×  
 159 यह अरज पत्र सवे लिख्यो पटना सो पुऊंचो जाइ के  
 160 पहिले ऊसेन अलीय बान लीन्हो लिखा सुषु पाइ के  
 बांघो सिराजुदी अली बां की दसा पकृताइ के  
 रिस घंटी अरज पछ्यो सो आपुहि ग्राहि के टिकआइ के ॥  
 बोल्यो कौनो अमीरन उम्मराव सु अरज ग्राहनग्राह सो  
 रिस रहति रोकौ नाहि क्यो हं अनुज को दुष दाह सो  
 165 पाऊं ऊकुम इलगार पऊंचो जंग जैतक चाह सो  
 ललकारि कै कु कु करि फेरों एजदीनहि राह सो ॥  
 तव ऊकुम कीन्हो ग्राहि दिन है अब तहमुल कीजिए  
 बांके वनैत अमीर तिन को विदा आगे दीजिए  
 अब रेजुदी सो रिस कहां ततवीर सो गहि कीजिए  
 170 फिर मोजुदीन पर साजि के घतुरंग फौज बलि कीजिए ॥

### पादांकुल छंद ।

और रोज भिगसार भयो जब  
 सभ्यो ग्राहि दीवान भास तव  
 भिसिण भिसिण ठाढ़े अमीर सब  
 लियो मुखतुजा बांन वलि अब

- 175           सैद मुरतुजा बां वदि आयो  
 साहनशाह ता को परमाथी  
 मौन साज बाझो चित कोने  
 प्रथम पछाहि पयानो कोने ।  
 ऊकुम होत ही फले महावल
- 180           सैद मुबतजा बाग साजि दल  
 कूष कूष बलमार पयानो  
 कियो वहादुरपुर धिर धानो  
 हजरति ऊकुम फेरि यह कियो  
 विदा सु आजम बां को दियो  
 ×       ×       ×       ×
- 347           अध सकल मीर अमीर सफिय  
 अरसला बां को हुकुम किय  
 पेशवानो सै पयानहु
- 350           कूष एकगर ठीक शमहु  
 अरसला बां ऊकुम धारो  
 चझो सजि दल द नजारो  
 पेशवानो सै पयानेउं  
 पांच कोस पयान ठानेउं
- 355           फभिर शाहनशाह सानेउ  
 सकल हंद गवंद गानेउ  
 वजी नौवति गह मही तव  
 भई नौवत रावरी अब  
 घोर धौंसा धनि अकारत
- 360           फतेह फतेह मनु पुकारत  
 हो ऊ हो करगाह बागत  
 शाहनशाह हि समुन बागत

- 365 सगुन सो सुरनाइ वाजी  
सिद्धि राम करीजु साजी  
भाह भाखव भांभ भनकत  
घनन जागिहि घंट बनघकत  
फौलवार निशान भहरत  
मनहु अगा फतूह फहरत  
आत पत्र अनूप राजत
- 370 इंद्र सौं प्रभुता विराजत  
भालरी मुकु ता सु लच्छक  
मनऊ तारा कृत्र रत्नक  
आफताववी हासकें कर  
मनहु रत्नक संग दिनि अर
- 375 तोग सुंदर माह माही  
सगुन की मनु देत ग्वाही

### छप्पै छंद ।

- फरकसियर समत्य ग्राह ग्राहं दल सज्जेउ  
पखर पखरि वज्जल वारवारन गल गज्जेउ  
380 श्रीधर धौसा धमक चोर दसहुं दिसान भर  
चमकत नेजे फहरवान वैरघ निशानवर  
भुव दलत मलत जेहि दिसि चलतका सोर चहु चक ऊव  
अतिअकक धुंधुरित धरि मफि आगताव धुवलोक धुव ।  
कौन सवल उत्यपिहि काहि निवल वल थपिहि  
केहि महीप को मुलुक मीडि काहि समपिहि  
385 काहि पाए गज रजि करिहि केहि पील पिठ्ठी पर  
घग घनी केहि थरिहि दरिहि केहि तमकि तेग तर  
अवहि मंडिहि षंडि सो केहि वढ़ गढ़ गढ़ पति थरथरेउ  
सजि गहनग्राह फरकसियत सो जव श्रीधर हय पखरेउ ।



## दोहा ।

- इमि सजि साहजशा जू कियो कोपि पयान  
 390 एलगारनि के कूच को कियोहि एंठिक ठान ।  
 कूच कूच एलगार सो बजुरां पज्जे आइ  
 आजमं बां सजि फौज सो दरसे प्रभु के पाइ ॥  
 साजि कहादुरपुर मिल्यो सैद मुबतजा धान  
 उतरि वनारस ईद करि एलगार कियेउ पयान ।  
 395 आनि वसेरे बीज अंसी कियो मुकाम  
 आए संग महावली हटि गे निमकहराम ॥  
 सयद अबदुल्लाह बां कौ मुलाजिमति आइ  
 कौ मुलाजिमति संगहौ जेतक संग सहाइ ॥  
 हाथी घोने पालकौ टंकौ फिरंगी कोर  
 400 सरोपाउ सरपेच सज जेगा मनसव और ॥  
 शाहजशाहि दीगे तिने कुतुवमुलुक किताव  
 दियो हिजाफो जौन जेहि मनसव को असवाव ।  
 सेतु बांधि मुरसरि उतरि प्राग सु पश्चिम और  
 चारि मुकाम तहां किए आगे दौरादौर ॥  
 405 मिल्या तिते फरजंद बां जगतजासु किरवान  
 सबल सजावति बां मिल्यो सैफ धान वलवान ॥  
 करे निकट महथा मिल्यो आइ हवीजे राम  
 चारि हजारौ राज पद तिन्ह को भयो सलाम ॥  
 अली असगर धान जू मिल्यो आनि हथियाम  
 410 चौ हजारि मनसव लह्यो धान जमान नाम ॥  
 पूरव ह्यो कुवरपुर विंदुकी पश्चिम और  
 बीच शाहि डेरा कियो भयो दुवन दल सोर ।  
 पश्चिम फतिहाबाद तजि पूरव विंदुकी ग्राम  
 एजदीन देरा दियो स कटक किते मुकाम ॥

- 415 धार वेद बंदक घनी कटक चारिहं कोट  
 चुने अरावे अगने भरी फौज तिहिं चोट ॥  
 दुह्र महावल फौज सौं तीनि कोस के बीच  
 रघी बीच रगभूमि सित मची दंति मट कोष ॥  
 शाहिजादो हिरउल कियो दलपति शाहनशाह  
 420 सने दलपति जित शाहि रते कीन्हे तित चाह ॥  
 अवदुल्लाह बां बंकरन हुसेगली बां माल  
 रन थंम आगें भए कुतुव कू डरीवाल ॥

### मधुभार छंद ।

- सज्यो अवदुल्लाह बां जित  
 सज ऊसेग अलीय बां तित  
 425 तित इनातुल्लाह बां सजि  
 रिस मुजाएति अली बां रजि ॥  
 × × × ×

### भुजंग प्रयात छंद ।

- 549 दुह्र घोर साने महामत दंतो  
 550 सने पखरो लख को पूर पंतो  
 मझा दार घेरें खिरि कटुवंटा  
 मजे मेघमानो बजे घोर घंटा ॥  
 घटा श्हाम सी दीह तांविं अधि माये  
 परां पखरैं भकरो भूल भापै  
 555 उजे पखरों मखरों लख घोरे  
 मनो भानु जी के रघी जोर जोरे  
 लखे चाह सौं चंचले चाल बाकी  
 दखारै तुदकी तकीजे ईररैकी  
 करै पौन सी पौन को पाचदारी

- 560  
 अरजी अरजी घुरीले बंधारी ।  
 नखे ताड की से पटी के चन्दावी  
 कही पीठ पूठों धले नीरराबी  
 सजे संवणी औ समुंदे सरंगे  
 कवूतो वने फूलवारी सुखंगे ।
- 565  
 जसे बीच संभाष बोले हरीले  
 मुसुली अजे पंचकखान पीले  
 वड़े डील के कान छोटे नबीने  
 सु चौरौ खुरी चाकरे जासु सीने ।  
 वड़े चंचले नैन के मुख सांचे
- 570  
 घुरीं वास भूमै घनी दीष वांचे  
 सजे साजियों चारिहं और जोधा  
 सजे साज जोहा बटो क्रत क्रोधा ।  
 पिले चारिहं और सूने गहुरी  
 जिन्हों वार के सपु की मौज चूरी
- 575  
 कहां लौकहों मौज में दूर राजे  
 किते की वलीले वंडूधै गराजि ॥  
 सबै दरिवां वीर वांके ब नेते  
 सजे साज वाजी चटे हांक दैते  
 कटे मौज लौं दांकि घोरे धपावै
- 580  
 किते कहं के कैसु भाले किरावै ।  
 बखी दूसरौ और माफ़ी अमोको  
 चयो कोपि के पूत दिह्यो धनी को  
 दुहं और ठाफ़ी चमूं बाहरों के  
 दुहं और के मौज ठाठे विलोकै ।
- 585  
 सु फजकसिबर शाहि के गोर सूवे  
 पिले चारहं और सजे अजूधै

वजी दीह धौंसानि आवाज अच्छी  
 चहं घां लषी जे बरच्छी बरच्छी ॥  
 कुटे ल्यो अरावे उठी धूरि भारि  
 590 धुवां की उठी धुंधुरारी अंधारी  
 वटै रोसनी ऊपरी वान छूटै  
 मगो आसमानी महालूक टूटे ॥  
 पिले घोट कों घोट कें चारि घेरे  
 पिले ओपची तोपची तोपो घनेरे  
 595 चहं पौज की बीर ता की बड़ाई  
 घमुं सज का चूर कै कै हटाई ॥  
 वली उतरी पौज के गवयेठे  
 महा मोरघा मीड़ि के पेलि पैंठे  
 लख्यो एखु वार कूटो दुवारो  
 600 परी भाग भाग्यो तकै कोह नारो ॥  
 सभारै न घोरे रघी हेम हाथी  
 सन्हारे न कोऊ कछू संग साथी  
 किहं छाड़ि घोरैनि डाचो हथ्यारी  
 किहं भागि सों आगेही पद्य धारो ॥  
 605 करे कोऊ हा हा परै कोऊ पैसां  
 चले रामरेंगा व भैभ्ना व कैभा  
 घुसे बाहरौ भागि केते निकामी  
 कीते को घरे वंदि नामीनि नामी ॥  
 कीते को सुगुमानी गखरैनि छाए  
 610 वटै हौसना के तिया संगल्याए  
 तिनै छोड़ि भागे कूटो चाल बांकी  
 गए फूटि ताले फटी हौसनाकी ॥  
 सरोवै असोले फसोले सहैकी

- 615 पुकारै बोदा आप दाकोन मेसी  
 गरो ढावरो भांकि भोवै सुरोसै  
 सबै मौजदी कों भरें नैन कोसै ॥  
 कङ्क वैदराको वड़ी धूमघाई  
 चङ्क लुंष लुंषांनि लै आगि जाई  
 वरै झांङ्गवनी झांङ्ग डेरा सु भारी  
 620 महा भौम पैसी धूवां की अध्यारी ॥  
 कङ्क आंच के तेज सों जास फूटै  
 कङ्क वैदरा वीर वाजार लूटै  
 कङ्क वांस की गांठि फूटै पटकै  
 चटाचट्ट पाषाण भारी पटकै ॥  
 625 लुटै केसरौ दास दाकी छोहारो  
 लुटै चाब कस्तूरी का घन सारो  
 कङ्क होत मोती वरें चूर चूना  
 कङ्क जैट लुटेरें करें मोट दूना ॥  
 630 जरै चार आचार चूरी चिरोंजी  
 कङ्क कौल गटे कसेब करौंजी  
 जरें बी लुटे चीर चीरा जरीके  
 परे मोट के मोट लूटे परीके ॥  
 भए वैदरा जौंहरौ लूटि लटे  
 छिटे ज्वारिकों मोट मुक्तानि छूटे  
 635 कितौ तीजरै हाय हारट्ट लागी  
 कितौ कामिनी दामिनी रूप भागी ॥

## दीहा ।

एहि विधि दल सब भंगियो एजुदी को जान  
 श्रीधर कवि आगु सुनो अब सब करो वधान ॥

- 640 अरज कियो इमखाज बाग प्रभु को पाह प्रसाद  
 शाहनशाहि यह साहिवै फतेह ममारण वाद ।  
 कियो बाग दौरा ऊतो उन को खंग हर जंग  
 नौसेरी बां गंद इत सु हो हिरौल रन रंग ।  
 अबदुलसमुद अलीख बां राजे बाग अमीर  
 सादिक लुतफुल्लाह बां दिलदिलेर बां बीर ।
- 645 मौजदीन के ए ऊते इतवारी उमराह  
 हजरति के एकवाल सो रहे न रन ठहराह ।  
 एजदीन को जवरई ले सब गए पराह  
 पीन घइ आए हुते पाणि पगए गंवाइ ।  
 हाथी घोरे सुतर रथ महल वहल सुभपाल  
 650 तोप नगारे रहकले हुतरनाल हथनाल ॥  
 मोहर जवाहिर को गने टेर ठौर ही ठौर  
 ठाठे कुटे सराइषे करी वीदरनि दौर ।  
 तहं ठाठे सुमताज बां हजरति निकट बोलाह  
 शाहनशाह कीनो हुकुम तुम देषो अब जाइ ।
- 655 मदमोकल हाथी तुरै तोप नगारो लेऊ  
 और लूटि मे जो लहि तोग ताहि को देऊ ।

### अर्धिक बंद ।

- करि फतेह शाहनशाह ज  
 हिय भयो परम उल्लाह ज  
 बैठे प्रभात देवान कै  
 660 सब बोलियो सगमान कै ॥  
 तहं वजत गौवति घोरचै  
 रह दीप दीप दोरचै  
 किय कांसु की इतमाम को  
 आए अमीर सलाम को ॥

- 665 मुकता जंवाहिर वारही  
 अंजुरी मिलै फिटकारहीं  
 फुंनि भांति भांतिन्ह नजरि दे  
 लै मिसिल ठाटे भे सवै ॥
- 670 कुतुवणमुणक अरजी भय  
 उमराय बोळि दु बोलाय  
 मिलिअो मुजफ्फर बां तह्हां  
 कौनी क्रपा सहेव जह्हां ॥  
 दीगो किताव धुरां धुरी  
 माने जह्हां वहादुरी
- 675 मिल्यो रहमति बां वणी हद  
 मुतह्हीवर बां लह्ही पद ॥  
 फिरि शाहि वकशिस साजियो  
 सिगरे अमीर नेवाजियो  
 हाथी महामद के दए
- 680 घोरे इरांक जएगए ॥  
 सुभ सरोपांण भलाभली  
 क्रिय कनक वार सभा थली  
 नेगा कलंगी भल भलै  
 सरपेच साज भले भले ॥
- 685 समसेर भूषण जाहिरी  
 सज करो फौज जवाहिरी  
 तेहि भूमि चारि मुकामु कै  
 सव कटक को विसरामु कै ॥  
 फिरि कूच कूच लगार को
- 690 जहं शहर शाहि मदार को  
 पडंथो तह्हां दनु वीर को  
 क्रिय दरस परसन पीर को ॥

दिन दस वसे तेहि धान जू

किय मेहर गरम देवान जू ।

[Only two lines to this verse in the original.]

## गीता छंद ।

- 695 फिर मीर जुमिला वीर उत सों अरजपत्र पठाइयो  
कासीद कागद कर लए दरवार द्वारे आइयो  
सुमताज धान लिधान ले सुव प्राहि पै पऊंचाइयो  
वह ले तकरख घां तहां मजमून वांचि सुनाइयो ।  
आकिल वकील वजीर सैयद अबदुल्लह धान को
- 700 काएथ सिरोमनि दास राए महीप सांडी धान को  
मिलि रह्यो मजिलिसि मौजुदी की सचक तत्व विधान को  
उन लिख्यो कुतुबलमुलुक को सब भेद जो परवान को ।  
इत मौजुदी मगरूर मस्त अल मस्त अमलै खाइ कै  
सिगरे कलांवत छै अमीर भरे रह्यो चितचाइ कै
- 705 आनै आनै मननि मै फलेरहैं इक भाइ कै  
माही मरातव अलम पंजा तोग गोवति पाइ कै ।  
दाह सु दाह भरत गोली अमल गोली रंग की  
मिरदंग ढोलक तोप औ सुरनाइ रीति तुफंग की  
प्याला पलीता सु भरकै तहं जीति मौजें भंग की
- 710 दिन रात यह घरचा रहै ततवीर और रन जंग की ।  
सब कमल लोचन दुःख मोचन काम रूप अगोहरा  
अति घतुर नृत्यक खानमे मघवान मंजिलिसि गोहरा  
अनुराग उपजत राग सुनि सुनि कवित रस के दोहरा  
मनु ढरे सांचे नवल नाचें गटामन के छोहरा ।
- 715 कहं सभा मस्त कलावंती कहं पातुरनि के गाहकी  
कहं नघत हरषे हीजरा भरि लगीऊ हिरआहिकी



- कहँ छोकरे वागे वने दरवार कुं जरै न राहकी  
 यह मौजदी की मौज है गति और नाहि निवाह की ॥  
 अथवार कोकिलताश्र वा अर जुलिककार वा लियो  
 720 दौऊ रहै दरवार में वर वैर आपुस में कियो  
 क्यों कटिन करहँ गेव रोगी मूँदि आंभिन घूटियो  
 [ Fourth line wanting in original. ] ॥  
 रह्यो माजिबुद्दी वां वली महमद अमी वां फूटि है  
 अवदुखमुद वां कमरुदी वां जकरिआ वां छूटि है  
 725 तहँ रहम रहमां वांन अर तूरानिजा सब टूटि है  
 पर पंच कौनो मौर जुमीजा जंग एगहिं जूटि है ।  
 इक रोज बैठे मौजदी मदिरा वढ़ायो मौज कौं  
 उतसाह सौं चित चाह भरि करि ऊकुम नव नव रोज को  
 तेहि वीधि आबो बवरिः आरक परकशाहि कगोज को  
 730 अर एजुदी भागे अर हमराह सिगरी फौज को ॥  
 यह सुनत एजुदीन भाग्यौ फौज संगरी भगी  
 तहँ सकल मजिजिसि मौज में इकवारगी दःख सो पगी  
 तव लगी मुख विष सो विरो अर गीत गारी सो लगी  
 अंग अमल की लानी घटी ततबीर औ डर रिस जमी ॥  
 735 कहां कौं लिखिए कथा सब रोति कहूँ देखि परी गई  
 हहरे कजावत गिरि गए मेह रागि को मुखका भई  
 कऊ परी उगमति लोककी सुधि ताल घुघुर की गई  
 सब गयो मद छूटि छाक सोरट ऊहि आहि दई दई ॥  
 अति रिस भयो मन मौजदी वकि उठत वारहि वार है  
 740 यह काम चूकि किबो दियो करि छोकरा सरदार है  
 फिर वे तमीज अमीर सिगरे लै गए अथवार है  
 मन मैं न आई मसजहति अपनी घता की हार है ।  
 बोने उसेन न अंग जानत वात की कथनी कथी

- कहं करो कुतपुष्पाह सादिक सांसुहै पागोपथी  
 745 करि संग दीने और सिगरे मसलहत तिन की न थी ॥  
 सफ जंग जीते सेद सों हमराह कौन महारथी ॥  
 अब मैं चलो सजि सामुहै कहि कौन धों ठहराईगा  
 मेरी अवाई सुगत सब दल एक एक पराइगा  
 सब ओस लो तकि उदित सूरज बूंद बूंद विषाहमा  
 750 गहिं बचन देहों भागेरुं रन भागि को कित जाइगा ॥  
 अब भोर सों करि दौर पऊंचत एक एक हिमारिहों  
 कोउ जियत जान न पाइ है दरवार द्वार पछारिहों  
 करि सेर दैहों मस अहारिन्ह टूक टूक बंटारिहों  
 फिरि वारहं की इंट उबारि जल में डारि हों ॥  
 755 मेरे भुजावण शाहिजादेन सों नगों लई गईं  
 तरवारि के वल फौज के वल हिंद की प्रसुता भई  
 रन मारि तीनों पातशाह हि पातशाहति मैलई  
 सुलितान चाहत सो दिखि वहकाह ल्याए औरई ॥  
 यह ऊकुम पठयो ताहि जे पऊंचे भगोरा आगरे  
 760 वैठे रहो उतहीं सवै निखि घाट घाट धराधरें  
 पुल तीनि बेगि बंधाइयो मजबूत वालंभपुर तरे  
 इलगार पऊंचत आइहों सफ जंग साज महा करें ॥  
 वकसी बोलाइ कछो सवारहिं साज सिगरो कौजिय  
 सब कों दु माहो पेशगी गनि रातिहिं दीजिय  
 765 करि मोर मंजिल कों विदा फिरि बबर सब थल कौजिय  
 ततबीर ऐसी साधि जो परं भाति राति चलीजिय ॥  
 फिरि ऊकुम कौन्दो निकट जे सिगरे अमोर बोलाइकै  
 ततबीर चने की करो सब राति रातिहिं जाइकै  
 सब साजि फौज प्रभात होतहिं होऊ हाजिर आइकै  
 770 इलगार उतरो आमरो मारों इंटारं धाइकै ॥

- यह ऊकम निकसतहिं एकाएक सहर बरभर सोर भो  
 साने अमोर सजी सवारी वजी नौवत भोर भो  
 जब खार भो बुद घटा घुमडी परे पाहन घोर भो  
 वद सगुन लखि सव कहै हाय कालिका को कोप भो ॥  
 775 दाहिने पर चौहू सनमुख वाम वोख्यो काग है  
 अब गई काटि गजी विषी थित राहरीत घराग है  
 आत पत्र निघान बंडित दंड परम अभाग है  
 जब खार मौजदीन भो वद सगुन लागलाग है ॥  
 दिन कटक माभ उलूक वोखत लूक टूट तरात है  
 780 कङ्ख खान रोवत सुरनि सों कङ्ख खार मन फिररात है  
 महरात सिर पर गीध के गनयो वजो उतपात है  
 हहरे सिपाही सुपन में सव भागियो वर रात है ॥  
 उतपात औ वद सगुन सिगरो मूढ मन बहराइके  
 एलगार पङ्खो आगरे ठहचो समोअर जाइके  
 785 तहं मिले एजुहीन औ सिगरे भगोरा आइके  
 सप जंग की कथनी कधी अति वात वनक वनाइके ॥  
 विकरार वोख्यो मौजदी अब सैयदों सों वूभि हों  
 रन मारि लेउं गनीम कों तव वारहाहि अरुभि हों  
 सिगरो फिसाद कौयो इन्हो दिल मांह कीन्हो सुभि हों  
 790 एई अगो हर जंग के इनको लजावत लूभि हों ॥  
 सादाति बां मारा जिद कों माणि नातावता  
 फरजंद बां तिस का पिसर सजि फौज आगे धावता  
 यह भयो जो समसामदौला तेग फर फर कावता  
 रन माभ मेरे सांमुहै अब कौन धों ठहरावता ॥  
 795 पहिले ह्वीले राम एजुहीन सो मौजरा कियो  
 फिरि जाइके उतहीं मिल्यो बदवत मौहि दगा दियो  
 अब अली असकर बां मिल्यो उत जाइके आगे है लियो

- मन में न ल्याए मोजदीनहिं देखिए इनको हियो ।  
 यों कहि मोहला लेन लाग्यो पांच लाख सवार भो  
 800 तित तो वधानो लाख द्वै गजराज कैक हजार भो  
 फिरि करी तोपन की शूलगे गगन धूआं धार भो  
 धुरि धरा धसकत मेरु मसकत सवल यों दल भार भो ।  
 यों लिखि सिरोमनि दास राय उलांक वेगि पठाइयो  
 दरवार कुतुबुलमुलुक के कासीद जोरी आइयो  
 805 सब अरथ साहेव राम माथुर प्रगट वांछि सुगाइयो  
 यह सुनत नैन रंगे भए अति वीर रस चित छाइयो ।  
 हंसि कछो अबदुल्लाह वां गलवा भयो उत ग्राह का  
 पाऊं जो अब मै नैकहं करि ऊकुम ग्राहगग्राह का  
 एकवाल फरकसियर को अब करम एक इलाह का  
 810 रन दौरि तोरों आनुहीं वल मौजदी की वाह का ।  
 मजमून सुनित तजवीज करि करि फेरि अपने कर लयो  
 खारी तयार भईनई असवार सैयदहै भयो  
 सुभ्राहाल मोहनि हाथ फेरत ग्राहि के मोजरें गयो  
 सब अरज कीनो अरथ ग्राहगग्राह को हिय हरषयो ।  
 815 वह मीर जुमिना को लिख्यो अरज सैद वजीर की  
 दोऊ वरावर सी विदी वरवात मीर अमीर की  
 अंधियानि सरस्यो वीर रस साहेव जहां रनधीर की  
 फर तेग वाहक हाथ फरक्यो बरी मोहैं वीर की ।  
 वर वारहांपति वीर सैयद वजीर त्यों अरजी भयो  
 820 आयो महमद घान वंगस साजि साज नयो नयो  
 असवार बीस हजार वषतरपोश व्यों घन उनयो  
 सभरैत वीर बली सबै पषरैत हाथी खी हयो ।  
 तव ऊकुम कौन्दो ग्राहि फरक वा को कियो कूष करार है  
 मिजिओ महमद वां मोहल्ला दै चख्यो इलगार है

- 825 हमराह वीर अमीर जंगी साज तेज तयार है  
 गहि अरसना बां पेशवानो चलत आजु अगार है ॥  
 खारी तयार भई प्रभातहि शाहनशाह सवार भो  
 मिलियो महमद बां सही असवार वीस हजार भो  
 घुद आपु पंज हजार सब सरदार मनसवदार भो
- 830 हमराह हिरउल के कियो एलगार वीर अगार भो ॥  
 करि कूच कूच लगार को एलगार पहुंच्यो आगरे  
 जल पियत जमुना को दुओ दल सवल वालभंपुर तरे  
 तित पार वार मोहार सों मिलि दलप दोउ देरा करें  
 ए पेलि चाहत पार उत्त वे घाट वाट धराधरें ॥
- 835 दुहुं ओर नौवत घोर घुमरत सकल जल हल कंपियो  
 दुहुं ओर भंहे भलमलें फहरानि उड़गन भंपियो  
 रजधान भानु विमान वे लषत असमान सु टंपियो  
 दुहुं ओर दल भर सहस फनिफन तुरग चरनि चंपियो ॥  
 दुहुं ओर वादल सूदल सूर मयूर ज्यों हरषा करै
- 840 दुऊ ओर तोपन को सलंगे गाज गरज रषा करै  
 दुऊ ओर घात कपिक गुनो गन किति सों कषा करै  
 ऊहुं ओर गोला वाग वूंदनि राति दिन वरषा करै ॥  
 दुऊ ओर भट ठट मन वटे सप जंग की अति मनमनी  
 दोउ पेलि चाहत पार भो नित टठत ठाठ दुओ अनो
- 845 लगि नीर आवत कुड उड़त दलप दोऊ दिल्लीधनी  
 विकरार धार महानदी पकतात त्वो दोऊ पनी ॥  
 तेहं वीच वजीर सैयद अरज आवतहीं कियो  
 प्रसु राज चक्षु प्रतक्षु लषि थल भवरि आनि हमें दियो  
 ककु दूर पश्चिम आगरे धाह जमुना को लियो
- 850 पायाव पारहुं वार लों सुनि शाहि को द्विय हरषियो ॥  
 करि भूठ दीन्दो गुलगुला तिरि भोजदी उरवार भो

- यह सोर भी चहुं ओर जोर दिखेर दल तैयार भो  
 काह फौज मेजि गनीम सुष पर ग्राहनग्राह तयार भो  
 तव राति रातिहि दौरि सैयद घहरि तरि करि पार भो ॥
- 855 अडि रह्यो जौन गनीम सुष पर फौज तोन वजाइकै  
 चलि कोस चारिक पहर एक तितै रह्यो ठहराइकै  
 जव भयो भोर अंदोर दहुं दिसि चछ्यो ध्यान वजाइकै  
 अति वेग तेंम धनेस जमुना कूल पहुंचे आइकै ॥
- 860 जव आनि पहुंच्यो जोर दल वल समय साधन सो सध्यो  
 अति धार भार बभार फनि पुर फनि सह सौ फन बध्यो  
 रजधान सों असमान मुद्रित सेतु सिंधुन मे बंध्यो  
 जल प्रथम को वनि वीच के चल पाहि के तरिवो गध्यो ॥  
 यहि भांति ग्राहनग्राहि जमुना उत्तरहि तें उत्तरो  
 पर ओर रोज विहां सं पुरव कोस द्वैक सिक्कंदरो
- 865 तेहि वीच सरिता निकट भोजुनि कटक को डेरा धरो  
 सुनते अवाई मौजदौ की फौज मे बरभर परो ॥  
 यह बवर सुनते मौजदौ मन मे महा रिस सो भरो  
 वकि उच्यो यारहु देवना अब दौरि जीवतहि धरो  
 वांचे न कोऊ भागेछू गहि एक एकहि संघरो
- 870 इन्ह कियो जाठ सु कै ठिठाई सो सजाई इन्हे करो ॥  
 कहियो करेरे नैन करि करिपि डेरनि ते कछ्यो  
 समसेर सरकत युनिस बरकत मोह परकत मन वछ्यो  
 चतुरंग अंगी साज जंगी मत्त मैगल में चछ्यो  
 धौवा धोकारत धरनि धुकि धवलोक धुरिन्ह सो मछ्यो ॥
- 875 हमरा हवै भट पाच काष भिलाष मव रन के भरे  
 सव जिरह वषतर पोश भखर वारहें पर पखरे  
 यह भांति राति वस्यो वलौ चलि और दक्षिण आगरे  
 फिरि भोर होतहिं दौर करि डेरा करे इसकंदरे ॥

- 880 रन भूमि बीच रघो सु अंतर कोस है दुऊ मौज सों  
 धित पूरवो पर ओर ओपरवार पूरव औज सों  
 दोऊ वीर बाँके हरधि हाँके त्यों अमीरनि सौज सों  
 पर मोर सनु संघारिए मजू अमन की मौज सों ।  
 संवत सु सत्रह वै ओन्हतरि पूस पून्यो बुध तहि  
 सम सो अग्यारह तेतिसा माहे मोहरम चौदहीं  
 885 अब पातसाही माह आज़र वाएसी ओधर कही  
 सप्त जंग की साएत सधो साहेव जहां कीनो सही ।  
 तित मोर सो जगि पहर है वनवारि धर वरबा कियो  
 जब बुले वादर हरम सों दिखो धनो उंका दियो  
 दस सने वीर अमीर सैयद वजोर तबहि यह रबियो  
 890 चतुरंग जंग उमंग रन भूमि पिखि पहिले कियो ।  
 पर वीर चढि ठाढो भयो हमराह सब खारो ठटो  
 जिहिं ओर जो दसु चाहिए तहि ओर त्यों मौजें वंटो  
 कहि मिसिल सिगरे अगुहरे रजधान सो सरिता पटो  
 अति सूर भंपत कुम्भी कंपत सेस की वलता घटो ।

### बिलास छंद ।

- 895 ऊकुम ग्राहि को लै गल गज्जेउ  
 कुतुबकमुशुक दाहिने सज्जेउ  
 वमतर पोध वीर हमराही  
 काल वारहें काल सिपाही  
 सैद सुर रन काल सिपाही अति उतसाही है हमराही सकल सजे  
 900 ने ग्राहि हुकुम कहि तेगे गहि २ मारऊ २ कहि कहि कहि गरजे  
 वागें ढोली धरो घोरें दप करि मन में भरि सप्त जंग मने  
 अबदुल्लाह मान सैयद के घौसे दखिन गहिरो वं वने ।  
 हीजाजाक जोरी जोहाबी

- पद्मी तरौन दूर सरवाणी  
 905 दाउदजई मेघगौ गनी  
 सु महमद विट्टनी पनी  
 विट्टनी पनी मनी मनी अस्य अरनी पधरैते  
 वनि वषतर भिलमे दाए दिख मै जेत कतिन मै सधरैते  
 पाठे पठनैतटे लोह लपेटे कोहनि पेटे अघरैते  
 910 यों अबदुल्ल बां संग वीर महमद बां वंगश अघरैते ।  
 × × × × × ×

### कवित्त ।

- 1109 रीभत जव नैक मौला घन की मंगन महि को सकल लहे  
 वरने कह लग्नि दीन के दारिद हेमवत्त सो सकल पद है  
 दरवाजे सदादान को धौंसा वजतु गहिरि वं व रहै  
 सुमताज घान वलवान वीर ऐसी विधि औधर सु कवि कहै ॥  
 × × × × × ×

### हीर छंद ।

- 1249 तव मौजही भन रोस के  
 चहुं और वांकी फौज के  
 हिरउल सु कोकिलताश बां  
 वल वंक वीर फतूहदां ॥  
 × × × ×

### हरिगीता छंद ।

- 1309 दुहुं और फौजे साजियो गलगाजि भट ठाठे भए  
 1310 बाजे नगारे फौलवारे घम धुनि धुव कंपए  
 धुर धार भार दुधार सों छटि हार दूरज भंपए  
 तह वहलकी भुमके मेरह हलत पहल समसुख वंपए ॥



- दुऊ ओर मौजनि मौज सो रन मौज देषादेश भो  
 हथगाल तीवै वाग जाल विसाल गरज अक्षेप भो
- 1815 घोरनाक घोर अंदोर दुहुं दल रहकला सवि सेष भो  
 पर वजीं वह कि वंदुष अगनित तित वनैतनि तेष भो ।  
 कड कड कडा कड सो अरावे कुटें तट पकनि टाप की  
 चहुं ओर घोर घटा मजी धुं व धार ताप तराव की  
 वर वाग वगरत वीजरी सम गोल ओला थाप की
- 1820 नहि पहरकै एक पिछानि का झरही पर की आप की ।  
 कुटि गयो धुंधूकार लो भिनुसार सो दुहुं दिसि भयो  
 बलकारि वीर अमीर सांवत चापसर कर वर लयो  
 रप करत आगे वाणि वागें मौज मोदमने भयो  
 वजि उठे माब माब माब अंदोर रन मंडल ह्यो ॥
- 1825 तहं तीर तर तर वाग सर सर सु भर भर गोला चले  
 पर पिमत आगेहीं आगेहीं सावत भूप भले भले  
 भोट बाल सुब सुब भरे पीरे रंग कायर हलहले  
 जिमि देषि जाचक दानि सुब सुम सुष दुष सुष वेकले ।  
 इत उत दुह दल के जितै जे वीर वीर वीरों विरे
- 1830 ते करनसाके वलिक वाके हांकि भट भट सों भिरे  
 समसैर सरकि सिरोहवार सन्हार सांवत सिर भिरे  
 दोनी भ्रमाभ्रम कि भरभ्र भूमि भूमि लेते गिरे ॥  
 × × × × × ×
- 1433 कल लैन दैतन रहकले हथगाल घन घुरनाल है  
 तूपान पहरत तूपंग की पहरात वाग विसाल है
- 1435 तहं तीर सलम समूह सम सुरलोक तरस रजाल है  
 असमान भानु विमान गोरुंकि भयो धुंधु काल है ।  
 तब वीर वीर विरां विरे मनु गहवरे भट भट भिरे  
 वजि उठे माह माह माह पुकार करि करि सुब भिरे

- वानैत गवोहै अरवो वीर गवो कर धिरे  
 1440 तहं होतइ हय काय को पर मुयन काइ धिरे ।  
 × × × × × ×
- 1453 चहुं खोर मौजनि मौज सों मन मौज माब मइहा परी  
 हथियार भार दुधार भर मनु मघा मेघनि को भरी
- 1455 गिर जिनम कुंडि कुरी कुरी किरि गई वषतर की करी  
 करि माब माब सन्हाब वार सन्हाब सुनि बतलल करी ।  
 घमन घटा घोर घमंड सो सम घुमडि पर मौज रह्यौ  
 धौंसे धोकारत गरज गहि तरवारि चमक छटा सही  
 भर तीर गोनिन वार गोना परत खोला स तहां महि
- 1460 मची भेदनि गूद कोच छपान सैचद जव गही ।  
 मद भरे भूमत बरे घाइ अघाइ करि वरघरि अरै  
 सिर सरत ओनि धार मनऊ पहार सो भरना भरै  
 वटि चली जोऊन की नदी लहरै लभे कहि को तहै  
 तेहि तीर दल दल मास को वल पठान काहुं को परै ।

### कवित्त छंद ।

- 1465 वकसत कहा मौज रोज रोज कवि गमत काहेते करत वानै  
 वीरन की कर है  
 हिम गिरि अरि हद कै हट को वदेस लागि कोन सेवु है कै  
 जीवो जस सो मयंकु है  
 औधर भगत पंच मुय को परम प्यारो पंच मुय विक्रम भर  
 धारे पांचे अकु है  
 कीरति महीपनि लाल अनुसाल नू को काहेते वटति विर  
 दातानि कंकु है  
 × × × × × ×

1533 परकसिधर शाहि जहादार शाहि रोज आगरे अगारी अरे  
पातशाहीहेत मै

श्रीधर वमत माखु वाने वाने वीर मुडि गई वगिं रहे  
केतक न चेत मै

अंगद सो अडो पादशाहति पणटि डाखौ एवो एतो  
आजम बां सवक वनैत मै

महा हव भारत को कमवैतो भारत को जैयो भीम भुज  
बल भाख्यो कुख्येत मै ।

× × × × × ×

1545 श्रीधर अवाई देवि परकसिधर जू को आयो मत  
मौजदी अनेक अभिजाय कै

धरि कु बमह घोर भाखौ गई सुदि वगिं अडिखो हवीये  
राम राजा मन भाव कै

मारि पर दल हरबायो भूष जो गिनी को करत वडाई  
सिवा संकर हि साव कै

एके वीर कैयो जाये एककैव आन्धो मन एकही गमत  
कैयो जाय कै ।

× × × × × ×

1599 शाही शादनामह को उखाह अति पतरन को अंग अंग  
वाढी रंग वाढीहीं रमत के

1600 तेरी पातशाही पातशाही पायो जेव फल श्रीधर सु  
वरमत के

श्रीधर भमत पातशाहन को पातशाह परकसिधर नर  
अवर भमत के

तिनके वकत जेवाई लमत तमत तूहि वैधत तमत वाढी  
वमत तमत के ।

- इति धीन धीन पक्षम ऊरी जेनीत पूरव अपूरव  
 हटैजो हाथ जायो है
- जीधर शाहनशाह फरकसियर नर सातों दीप तरहंद  
 हिन्द के मिजायो है
- 1605 दिग दिग वाछतहि वाछही दिग दिग दिग दिग वूनि  
 पातशाहत वढायो है
- पातशाह पातशाह पातें जेव पाए ती लो  
 पातशाहि जेव पायो है ॥
- घेरो सारा वतार भीरो सु वदार दल मल धूद  
 कीजो छीन खुरो की
- धावा करि पूरव तें डावादार मौजनि की भीगा लो  
 वकर लीजो शाह जौनदी की
- जीधर भगत वातशाहन की वातशाह फरकसियर  
 भू पनाह दीऊ दीन की
- 1610 मुसुक मुसुक दीरें खवरें मंगुहन की कापियो डर  
 गव्वर हरब वढयो दीन की ॥
- कोऊ टुंजो कोऊ दाह काहू में न गुन भारो कोऊ  
 वारनारो वस में न आधियो है
- सुन्दर सुनिवान मुजा शीनवन्त और जवान  
 भूरी एक तोहि विधि नय बनायो है
- जीधर भगत सागी जलासुदीन अकवर वातशाह  
 फरकसियर वातशाह भर पायो है
- 1614 बाण पातशाहित लो पूर करि करत तोहि देख  
 दीऊ जे जे माणा पहराइयो है ॥

x x x x x x

TRANSLATION.

[Lines 1-4, Invocation.]

- 5 Çridhar *alias* Murlidhar, twice-born, lives in Prāg,  
 By telling this pleasing tale of kings he increases affection ;  
 Farrukhsiyar the king is young, strong, eloquent,  
 And the giver of gold to all the nobles.  
 A trader's letter came, suddenly arose desire,  
 10 Having vomited, Bahādur Shāh went to heaven.  
 Hearing the news, forthwith the generous Farrukhsiyar  
 Decided to raise a force and make a rapid march,  
 He sent for his *Bakhshī*, A'zam Khān, and gave order :—  
 "Now let troops be raised, as many as can be got."  
 15 Then, after ten days or so, came the trustworthy news,  
 Zū'lfiqār and the nobles had all gone over to Mu'izzu-d-din,  
 Zū'lfiqār Khān lead astray all the army, using deceit,  
 Otherwise who could overcome in battle one so powerful.  
 Mu'izzu-d-din raised the umbrella, ordered the public prayer  
 perversely,  
 20 Set out for Dihli, wrote and sent out rescripts to the four  
 quarters.

Tomar Chand (21-38).

- When this news came  
 Then the wise Farrukhsiyar  
 Called for all the nobles,  
 Conferred gifts on all the heroes.  
 25 To all he gave the order—  
 "Now get together an army."  
 After this order, the next morning,  
 He raised the umbrella, sat on the throne,  
 All the king's friends  
 30 Then began to enlist soldiers,  
 'Abdullāh Khān made ready,  
 He fell into a great rage,  
 The king's order issued,  
 He reached Allāhābād.  
 35 Of *gūbah* as well as *sarkār*,  
 Of all he took full possession,  
 The heroic head of the vanguard  
 Set up his armed posts.

Doharā (39-70).

- Then Mir Jumlah, a noble, clever, deep, strong of arm,  
 40 Fought Mu'izzu-d-din's army, grasping the sword,  
 Arranged all the *shūbahs*, walked circumspectly,  
 And reported all the facts to the king, where, when, and how.  
 Thus Mir Jumlah, the hero, reported in a long letter—  
 "They have made Sayyid Rāji **Khān** governor of Prāg,  
 45 "He has started, his avant-garde is Sayyid 'Abdu-l-ghaffār,  
 "Behind comes a great army led by Prince 'Izzu-d-dīn."  
 When all these details from Mir Jumlah, the hero, arrived  
 Before the king, shelter of the world, the powerful Farrukh-  
 siyar,  
 Hearing them and looking at the nobles, with fitting anger,  
 50 Spoke Ḥusain 'Alī **Khān**, the fighter of Kūrā, strong as an  
 elephant,—  
 "By this the fortunes of the king of kings are not one  
 moment threatened,  
 "To meet him 'Abdullāh **Khān** singly would be enough,  
 "Let grace be shown him quickly, send him a written com-  
 mand,  
 "That wretched army will he rend, will overcome it in battle  
 array."  
 55 When the rescript that the king of kings had written arrived,  
 Sayyid 'Abdullāh **Khān** took it, carried out the usages of  
 respect,  
 He placed the order on his head, with his drums remembered  
 his Lord,  
 He raised tents towards Ālam Cand and blocked the road.  
 Then he stood fast, making Prāg his fixed place,  
 60 Sent on his brothers to battle, under them all the leaders,  
 Thus joined Saifu-d-dīn 'Alī **Khān**, brave, heroic, liberal,  
 Najmu-d-dīn 'Alī **Khān**, the fierce, started sword in hand,  
 Sirājū-d-dīn 'Alī **Khān**, too, joined, the brave and strong;  
 There also came Rājā Ratn Cand, the wise, armed with  
 sword,  
 65 Mir Muḥsan **Khān** also joined and brave Anwar **Khān**,  
 Then joined Samandar **Khān** and Yādgar Beg, the fighter,  
 Mirzā Wali Bahrām Beg, mounted, grasping his bow,  
 (He whose father is Barqandāz **Khān**, a title he too obtained),  
 Darwesh 'Alī **Khān** joined, the Sayyid marked for victory,  
 70 There came many brave leaders, severe and proud of nature.

Harigit (71–170).

- This side halted at Ālam Cand, that side encamped at Kohu,  
 On both sides when day broke both lords of battle beat their  
 drums,  
 As these mounted, those advanced, full of zeal both seized  
 their reins,  
 The whole army was in agitation, and the court beloved of the  
 sun ;
- 75 When the armies came in sight, they both cocked their guns,  
 Muskets, swivel-guns, elephant-pieces sounded loud as thunder,  
 Then lightning gleamed and glistened as the swords left their  
 scabbards,  
 It began like heavy rain of sorts, in the mēlée blood ran in  
 streams,  
 Urged on with unceasing cries, the brave warriors galloped,  
 both armies rushed,
- 80 Seizing their swords, jumping and springing, they delivered  
 blows,  
 One moment down, then up again, and the next moment on  
 without flinching,  
 For six hours, in confusion, the heroes braved the clouds and  
 streams of war.  
 [The Sayyids fight on (83–98) till Sirāju-d-dīn ‘Ali Khān is  
 killed].
- 99 Having made firm his heart, the Bārḥah boy,  
 100 Sayyid Sirāju-d-dīn ‘Ali Khān, received his martyr’s crown,  
 Joyous from the Hūri’s hand he drank the full cup of love,  
 He did his duty loyally, bestowed lustre on the illustrious  
 army.  
 Thus noise arose on every side, all the leaders rushed,  
 Advancing they threw down buckler, cast off head-pieces, tore  
 their shirts of mail,
- 105 Quitted breast-plate, broke their scabbards, laid hand on  
 dagger,  
 Lances glittered everywhere, the sword blows fell many and  
 thick.  
 Meanwhile men ran from all sides, surrounded the whole army,  
 There arrow, spear, rocket, bullet, reddened body after body,  
 Swords shone and glittered, daggers wounded with a “kar-  
 kar,”
- 110 Tossed to and fro the crowd struggled, the chiefs of the army  
 stood fast.

Many lay on the ground writhing, many wandered wounded,  
Many were like to faint from fear, and died without being  
struck.

The leader, 'Abdu-l-ghaffār's, body was covered with wounds,  
In the battle-field he knew not where nor how to hold his  
footing.

115 Then the army made off, the scamps rob the money bags,  
He whose foot had no shoes was exalted on horseback ;  
Rushed the famous one, shouting the king's name, threatens  
with thumps,

Wherever he goes the hero bears the decree of victory.

When Mirzā Manzūr told all the story to Quṭbu-l-mulk,

120 The drums beat with long throbs, delight blossomed in his  
breast,

Hearing of Sirāju-d-dīn 'Ali Khān's fate, he fell into a rage,  
His eyes stared, he twisted his moustache, his teeth bit his lips.

Then spoke 'Abdullāh Khān, " Now will I fight a great fight,

" To cut to pieces the whole western army I draw my dagger,

125 " As many leaders as are come, their souls shall pay the  
penalty,

" None shall be let go till I am revenged for Sirāju-d-dīn ' Ali  
Khān ;

" In a battle-field like Kūrukhet, I will raise a contest of  
swords,

" By strength of arm when I and my kindred have been  
wounded unto death,

" Then may I be styled a faithful follower of Farrukhsiyar."

[Line 130 is wanting. (Lines 131-138) The Sayyid's brothers  
return to Allahābād ; they and their commanders are com-  
mended and rewarded.]

139 Next day Quṭbu-l-Mulk called for Ṣāhib Rāe, and said,

140 " Write to the king of kings the news, telling the whole story ;

" Write to brother Ḥusain 'Ali Khān, instructing him of all,

" Wherever he is, let him hurry here, gathering a sufficient  
army."

Ṣāhib Rāe, the Māthur, heard and wrote there and then a  
letter,

Told of the battle array, all things as they happened—how,  
where, and when,

145 The repulse of the western force, the advance of the nobles ;  
Again he wrote to Ḥusain 'Ali Khān the whole story.

[The contents of the letter are then given (lines 146-158).]



- 159 This humble letter was sent off and reached Paṭnah,  
 160 First Ḥusain 'Ali Khān took the letter and was pleased,  
 Read of Sirāju-d-din 'Ali Khan's fate and sorrowed,  
 When his anger had decreased, he read out the petition to the  
 king.  
 Thus spoke the noble of nobles to the king of kings:—  
 " When angry, none can stop me ; my grief burns for my young  
 brother,  
 165 " Give me orders, I make forced marches, I am ardent to fight,  
 " By calling " hish-hish " I will turn 'Izzu-d-din back."  
 Then the king gave orders—" Please wait a day or two,  
 " Let some smart, loyal noble be sent off ahead,  
 " What good is rage at 'Izzu-d-din now, better take counsel,  
 170 " Then let us start with a perfect army against Mu'izzu-d-din."

Pādānkul Chand (171-376).

- Next day when morn appeared  
 Then the king held privy audience,  
 Group by group stood all the nobles.  
 Murtaẓā Khān took the lead.  
 175 Sayyid Murtaẓā Khān advanced,  
 The king of kings addressed him,—  
 " See to getting ready an army,  
 " You be the first to start to the west."  
 Instantly obeying, the hero went.  
 180 Sayyid Murtaẓā Khān took an army,  
 Set out by forced marches,  
 Made Bahādurpur his fixed camp.  
 Again His Majesty gave an order,  
 A'zam Khān was despatched.

[Here follow (185-228) the names of many men who joined.  
 Darbars were held daily. Ashraf Khān arrives and is made  
 Khān Daurān, 229-236. Ibrāhim Ḥusain was sent towards  
 Bhāgalpur, 243, 244. Ghairat Khān was left in charge of  
 Paṭnah, 251, 252. The following couplet, 257, 258, is worth  
 quoting for the quaint inversion in the second line:—

*Sajjo Husen Alie Khān, bal,  
 Mahābīr, Umrāu-amīr-al.*

- He took command of the vanguard. We come next to Far-  
 rukhsiyar's march from Paṭnah.]  
 347 All the nobles and chiefs got ready,  
 The order was given to Arslān Khān,—

- “Take out the advanced tents,  
 350 “Count the forced marches exactly.”  
 Arslān Khān obeyed the order,  
 Mounting took his army with drums beating,  
 He took out the advanced tents,  
 Marched five kos and encamped.  
 355 Next morning the king of kings started,  
 The throng of elephants roared,  
 The royal march was beaten loudly.  
 Then played the music of His Majesty,  
 The big drums shook with mutterings and growlings,  
 360 Men shouted “Victory ! Victory ” !  
 The trumpets brayed “ho-hū-ho,”  
 The king of kings’ good omens appeared,  
 The hautboys sounded happy augury,  
 Rāma and the sages joined the throng.  
 365 “Clash, clash,” clanged the cymbals,  
 Jingling bells began their “tinkle, tinkle,”  
 The elephant-riders displayed their standards,  
 In front ran men shouting “Victory ” !  
 Everywhere incomparable brightness reigns,  
 370 The splendour is as that of Indra’s heaven,  
 Fringes hang over their faces,  
 Guardians of stars and umbrellas,  
 Sunscreens waving in their hands.  
 Hearts full of joy shout for the Faith,  
 375 Yak-tails, *sundar*, the fish-dignity,  
 Give evidence of happy augury.

Chappai Chand (377–388).

- Farrukhsiyar, powerful, king of kings, led his army,  
 Many armour-clad elephants trumpeted and roared repeatedly,  
 The lordly drums resound and thunder, filling all the air,  
 380 Lances glitter, pennants flutter, as also the ensigns,  
 Soldiers wherever you turned, uproar everywhere,  
 It was very dark from mist, the sun hidden, the sky covered.  
 No strong man failed to arise, the weak ones gathered up  
 strength,  
 Many rulers came from afar to conquer kingdoms,  
 385 Many were lords of elephants, many sought that rank,  
 Many swordsmen stood, holding proudly sword and sabre,  
 Now from every hut and corner throngs of men confusedly  
 jostled,

To join Farrukhsiyar, king of kings, whose good fortune called aloud.

Dohā (389–422).

- Meanwhile the king of kings marched in extreme rage,  
 390 Made forced marches, halted at several places.  
 By hurried stages he reached Khajurān,  
 A'zam Khān rejoined and beheld the face of his lord.  
 At Bahādurpur they found Sayyid Murtaẓā Khān;  
 Crossing to Banāras they observed the 'Īd, then hastened on,  
 395 Came through Baserī, encamped in Jhūnsī,  
 The valiant followed, the faithless vanished.  
 Sayyid 'Abdullāh Khān did homage,  
 With him made obeisance all his followers;  
 Elephants, horses, litters, swords, shields, weapons,  
 400 Robes, jewelled aigrettes, and high rank  
 The king of kings gave with the title of Quṭbu-l-Mulk,  
 Gave promotion and all things pertaining to rank.  
 He made a temporary bridge, crossed to the west of Prāg,  
 There halted four days, then rushed again onward.  
 405 Then came Farzand Khān, world-renowned swordsman,  
 Strong Ṣalābat Khān came and Saif Khān, the valorous,  
 Acting ever a leader's part Chabila Rām appeared,  
 As his welcome he was made Rājā and *Cār-hazāri*.  
 Next joined 'Ali Aṣghar Khān, who came to Hāthigrām,  
 410 Received the rank of *Cār-hazāri* and the name of Khān  
 Zamān.  
 Passing east of Kumwarpur and to the west of Bindukī  
 The king encamped between them; there was tumult in both  
 armies.  
 Leaving Fathābād on the west and on the east Bindukī village,  
 'Izzu-d-din placed his tents and encamped his army,  
 415 Fenced himself and dug a ditch, made a fort round his army,  
 Collected countless carts, made of them a bulwark to his force.  
 The two strong armies lay three *kos* apart,  
 Kept the battle-field in the midst, the mad elephants trampled  
 it into mud.  
 The prince was sent in advance by the ruler, the king of kings;  
 420 When the king's army arrived, they had forthwith desire.  
 'Abdullāh Khān, quick in battle, the champion Ḥusain 'Ali  
 Khān,  
 In front of the battle-pillar went the upholder of the Axis.

Madhubhār Chand (423-548).

- 423 Then joined ‘Abdullāh Khān  
 Also Ḥusain ‘Ali Khān,  
 425 ‘Ināyat Khān, too, joined,  
 And Shujā‘at ‘Ali Khān, the fierce.  
 [Then follows (427-548) a long list of chiefs and nobles, each  
 with some epithet.]

Bhujangprayāt Chand (549-636).

- 549 On both sides were ranged the raging tuskers,  
 550 Clothed in armour, row upon row,  
 The mace-bearers surrounded them, their heads were  
 lacerated,  
 The dusky ones screamed, the loud bells rang.  
 Their bodies like lowering clouds, great beyond measuring,  
 Bearing iron armour, covered with fringed housings.  
 555 Thousands of armour-clad horses came clattering,  
 It seemed like the sun’s chariots gathered together.  
 Eagerly, with playful gait, went the spirited ones,  
 Streams of Turki, Tāzi, Īrāqī horses,  
 They steadied each other, foot close by foot,  
 560 Arabs, and western ones, sportive Qandahāris.  
 They leapt like acrobats, their forelocks plaited,  
 Flanks, backs, loins, eyelids, free of fault,  
 Cream-coloured, bright bays and chestnuts,  
 Handsome shapes making a flower-garden.  
 565 Like the splendour of borders, blue and green,  
 Dark bays, with the five lucky marks, and light duns,  
 Great in girth, small-eared, full of youth,  
 Their hoofs large, their chests broad.  
 Restless-eyed, their heads good-tempered,  
 570 Hoofs and coat shining, compact, ready for fatigue ;  
 Warrior allies came from all quarters,  
 All the iron-clad heroes joined, boiling over with rage.  
 Everywhere proud governors jostled each other,  
 A crowd enough to pulverize the enemy,  
 575 Wherever you look the army is full of kings and heroes,  
 Many strutting about discharge their guns.  
 All the valorous, heroic, active, loyal,  
 Came with harness rattling, mount with shouts,

- Issue from the army, and shouting urge their steeds ;  
 580 How relate the twirling of their spears !  
 Behold on the other side, rare and undaunted,  
 Advances raging the ruler of Dihli's son ;  
 On two sides stand the enemies like flower-beds,  
 On two sides the armies stand looking.
- 585 With king Farrukhshiyar are the governors of provinces,  
 A wondrous crowd of allies jostled everywhere,  
 Loudly resounded enlivening music,  
 Everywhere spears thick as gathering clouds.  
 As the field-pieces fired a great dust arose,
- 590 There arose from the smoke great clouds and darkness,  
 Flashes of light came where the rockets flew,  
 It was as if the great vault of heaven had burst.  
 They threw their missiles, doing harm every time,  
 Armed men and gunners fired many cannon,
- 595 The heroes of both armies advanced,  
 They dispelled and trode into dust the enemy's array.  
 Verily that army's conceit deserted it,  
 Taking the chief batteries they crowded in,  
 'Izzu-d-din's men began to quit the walls,
- 600 Turned and fled on beholding those wrathful men.  
 They abandoned horses, carriages, gold, elephants,  
 No one collected aught of his belongings,  
 Some left their horses, threw down their weapons,  
 Some fled, taking the road in front of them.
- 605 Some moaned " hā, hā," some fell at the men's feet,  
 They went creeping and crawling, as best they could,  
 They ran out and fled, those miserable wretches,  
 Many stood calling aloud the names of God.  
 Many mighty men abated their pride,
- 610 Valourously abandoned all they had,  
 Leaving all they fled, forgot their strutting gait,  
 Their star had set, their wits had fled :  
 Everybody, servants, learned men, waiting maids  
 Calling " Lord ! bestow on us some helper " !
- 615 [Garo dhāwaro jhānki jhībai surosai,]  
 All piled on Mu'izzu-d-din fitting curses.  
 Some seized on money-bags with great glee,  
 Everywhere the camp plunderers ran with torches,  
 Lighted the thatches and the mighty tents ;
- 620 Great fear spread, the smoke made a darkness.

- Here from the hot flames red light broke forth,  
 Elsewhere the heroes of the *bāzār* stole the money bags,  
 There the bambū knots split with a spluttering sound,  
 Crashing and snapping, the heavy thatches crackedled.  
 625 They plundered saffron, wine, spirits, dried dates,  
 They took all the bags of walnuts and musk,  
 At places pearls were burnt into powder and dust,  
 Everywhere squatted plunders tying huge bundles.  
 Pickles, powders, and *cironjī* nuts were burnt,  
 630 Elsewhere jujube fruit, tubers, and fever-nuts,  
 They burnt or took clothes and turbans of gold brocade,  
 There lay about many bundles, women were robbed.  
 The jeweller's bags were carried off,  
 The jewellers dispersed, their bundles lay scattered,  
 635 Crowds of traders cried, "Alas! we are undone,"  
 Numerous lovely women fled, their faces veiled.

Doharā (637-656).

- Know then that thus fled 'Izzu-d-dīn and all his men,  
 Listen to Çrīdhar, the poet, as he tells the whole story.  
 Imtiyāz *Khān* reported, bringing a good gift for his lord,  
 640 "My Lord! may this victory be of good fortune to the king  
 of kings!  
 "They sent *Khān* Daurān as chief, one fit for any enterprize,  
 "Nansheri *Khān*, his son, was sent with the vanguard to  
 battle.  
 "Abdu-ṣ-ṣamad *Khān*, Rāje *Khān*, the noble,  
 "Luṭfullāh *Khān*, Ṣādiq, Dildiler *Khān*, the brave,  
 645 "Such were the nobles trusted by Mu'izzu-d-dīn,  
 "Against your Majesty's good fortune they could not stand  
 in battle;  
 "From 'Izzu-d-dīn's harshness all went wrong,  
 "They came to eat *pān*, they threw away hand and foot,  
 "Elephants, horses, camels, ox-carriages large and small, litters,  
 650 "Cannon, kettle-drums, swivel-pieces, camel-guns, elephant-  
 guns,  
 "Gold coins, jewels uncounted, in heaps strewn everywhere,  
 "The vacant enclosure stands, surrounded by bags."  
 There stood Mumtāz *Khān*; His Majesty called him near,  
 The king of kings gave order—"Go you now and see,  
 655 "Take the war elephants, trumpets, cannon and drums,  
 "All the rest of the plunder leave with whoever took it."

Ardhik Chand (657-694).

- The king of kings having gained a victory,  
 His heart was filled with supreme delight ;  
 In the morning he sat in audience,
- 660 All spoke words of reverence.  
 Then sounded the royal music loudly,  
 It sent forth its loud, shrill cries,  
 They summoned dancing women,  
 The nobles came to make obeisance.
- 665 Many jewels shone,  
 White, blue, and crystal,  
 They offered gifts of many sorts,  
 They all stood group by group.  
 Quṭbu-l-mulk made his petition,
- 670 Asked for two nobles to be called,  
 Then Muẓaffar **Khān** was presented,  
 The Lord of the World conferred favours,  
 Gave the title of the very utmost degree,  
 “**Khān Jahān**” with “Bahāduri” :
- 675 Raḥmat **Khān**, bravest of the brave, attended,  
 And received the title of Mutahawwar **Khān**.  
 Then the king bestowed gifts,  
 Rewarded all the nobles,  
 Gave elephants, fierce in battle,
- 680 ‘Irāqī horses with saddles.  
 Auspicious robes of honour glistened,  
 Made the assembly a golden garden,  
 Turban ornaments glittered, plumes fluttered,  
 Lovely jewelled bands and trappings,
- 685 Jewelled swords were displayed,  
 The whole army was covered with jewels ;  
 On that spot they made four halts,  
 All the army took repose.  
 Then began again the long marches ;
- 690 Where stands the town of **Shāh Madār**,  
 There the lord of the army arrived,  
 And worshipped the wonder-working saint,  
 Some ten days they halted there,  
 Many gifts were given in the audience hall.
- J. I. 6

Gitā Chand (695–894).

- 695 Again Mir Jumlah, the hero, forwarded thence a report,  
The runner with paper in hand came to the darbār door,  
Mumtāz **Khān** took the writing, delivered it to the king,  
Taqarrub **Khān** took it, and forthwith read out the contents.  
The clever agent of the Wazir, Sayyid ‘Abdullāh **Khān**,
- 700 The *Kāyath*, Siroman Dās Rāe, lord of Sāṇḍi town,  
Frequenting the audiences of Mu‘izzu-d-din he learnt the truth,  
He wrote to Quṭbu-l-mulk all the news of importance.  
“ Here Mu‘izzu-d-din, puffed-up, maddest of the mad, goes on  
drinking,  
“ All the musicians are made nobles, they do what their heart  
desires,
- 705 “ At every moment in their mind arises joy for some brother,  
“ Who has got fish-dignity, flag, hand, yak-tail, and kettle-  
drums.  
“ They load with wine, their bullets are opium pills,  
“ Long and short drums are their cannon, long horns replace  
muskets,  
“ Instead of a gun-match they fill cups, they conquer floods of  
*bhang*,
- 710 “ Night and day are thus noised abroad their plans for war and  
battle-field.  
“ All the lily-eyed, pain-quelling beauties are collected,  
“ The cleverest dancers wave in the hall their dusky locks,  
“ Passion kindles by their songs, he hears sweet poet’s rhymes,  
“ He beholds attentively the dances of the pretty juggler boys.
- 715 “ Here a group of drunken players, there the overtures of loose  
women,  
“ Here dance joyous eunuchs, moving with great quickness,  
“ There boys run about, making the *darbār* a sodomites’ resort,  
“ This is Mu‘izzu-d-din’s madness, he attends to nothing else.  
“ Power is usurped by Kokaltāsh **Khān** and Zū’lfiqār **Khān**,
- 720 “ Both attend the *darbār*, there is great enmity between them,  
“ As a sick man shuts his eyes and gulps down bitter juice  
reluctantly,  
[Line wanting in original.]  
“ Brave Ghāziu-d-din **Khān** and Muḥammad Amīn **Khān** have  
been gained,  
“ ‘Abdu-ṣ-ṣamad **Khān**, Qamru-d-din **Khān**, Zakariyā **Khān**,  
have come over,
- 725 “ Then Raḥīm **Khān** and all the Tūrānis have been got at.



- “ They have made Mir Jumlah referee, will join and fight for him.
- “ One day Mu‘izzu-d-din sat, streams of wine were flowing,
- “ Full of happiness to his heart’s desire, he gave new orders for each day ;
- “ In the midst of this came the news,—‘Farrukh Shāh is at Kannauj,
- 730 “ ‘ And ‘Izzu-d-din has fled, taking with him all his army.’
- “ Hearing of ‘Izzu-d-din’s flight, that all his army had fled,
- “ The whole drunken gathering was forthwith immersed in sorrow,
- “ Then began their mouths to burn as if poisoned, the songs sounded like curses,
- “ Their drunken joy subsided, thought and fear and anger awoke.
- 735 “ It is too much to write all the story, nothing received attention,
- “ Perturbed, the musicians made ‘rain,’ the queen went into a swoon,
- “ Drums of sorts were dropped, they forgot their cymbals and rattles,
- “ Drunkenness vanished, the wine-cups dropped, the tunes stopped, they cried and groaned.
- “ Mu‘izzu-d-din was exceeding wroth, time after time he talked wildly,—
- 740 “ ‘ This affair has mis-carried because I made a child into a leader,
- “ ‘ Furthermore, power was granted to a group of injudicious nobles,
- “ ‘ My mind conceived not wise plans, the defeat is through my own error.
- “ ‘ Khwājah Husain knows naught of war, nor the intricacies of affairs ;
- “ ‘ Where did Lutfullāh Khān ever fight, he of Pānipat, the True One ?
- 745 “ ‘ With them went many others, none of whom could give advice,
- “ ‘ Among them who was skilled to overcome the Sayyid in battle array ?
- “ ‘ Now I start with my followers, say, who will stand fast, and how ?
- “ ‘ Hearing of my approach the whole army will fall to pieces,

- “ All the dew, every drop of it, is dissipated by the risen sun ;  
 750 “ I will not spare one rebel ; who will there be to appear in  
 the field ?  
 “ Now to-morrow I will run and arrive with all my followers,  
 “ Not one will be let go alive, I have thrown down the door  
 of audience,  
 “ Like a tiger I will devour their flesh, I will divide them  
 into little bits,  
 “ Then rooting up Bārah brick by brick, I will throw it into  
 the water.  
 755 “ By my strong arm I obtained superiority over the Princes,  
 “ By strength of sword, by strength of war I became lord of  
 Hind,  
 “ Defeating three Kings in battle, I took the sovereignty,  
 “ He claims the throne and to seize Dihli by stratagem.’  
 “ This order was sent, when the runaway reached Āgrah,  
 760 “ Stand fast there all together, seize all the fords and ferries,  
 “ Quickly erect three strong bridges below Bālabhpur,  
 “ I come by forced marches, collect supplies for a campaign.’  
 “ He sent for his *Bakhshī* and said ;—‘ Make ready the horsemen,  
 “ Count out to all a two months’ advance, give them supplies,  
 765 “ Send off the quarter-master-general, then see to every place,  
 “ Make such plans that you may start in good order this night.’  
 “ Next orders issued to send for all the nobles near at hand,  
 “ He enforced on them the order, they must move that very  
 night ;  
 “ As morn arose the whole army must gather in splendour,  
 770 “ Must hurry on to Āgrah and occupy Iṭāwab,  
 “ As soon as the order went forth, at once arose confusion and  
 shouts in the city,  
 “ The nobles armed, the horsemen made ready, at dawn the  
 kettle-drums sounded ;  
 “ When he himself mounted, thick clouds gathered, great  
 dread arose ;  
 “ It was an ill omen, all said—‘ Alas ! Kālī is angry ’ !  
 775 “ On the right a kite called, in front to the left a crow croaked,  
 “ And a cow’s throat was cut, cats spat, and wrangled,  
 “ The standard caught, the staff broke, a very bad omen,  
 “ When Mu‘izzu-d-din started, evil omens succeeded each other.  
 “ In daylight an owl screeched amidst the camp, and foxes  
 called,  
 780 “ Here a dog howls like a *suranī*, there a pack of jackals yells,

- “Groups of vultures whirl over their heads, this is very unlucky ;  
 “The soldiers in their dreams thought they fled all the night.  
 “With their heads all full of portents and evil omens,  
 “They speedily reached Āgrah, halted at Samūgarh ;  
 785 “There came ‘Izzu-d-din and all the runaways,  
 “As to the hardships of the battle they invented many fables.  
 “Angrily spoke Mu‘izzu-d-din;—‘I will now pay out the Sayyids,  
 “‘When I have overcome the enemy, then I shall triumph over the Bārḥah,  
 “‘All the trouble is their doing, rancour appeared in their hearts,  
 790 “‘I will fight them in every way and try conclusions with them.  
 “‘Sādāt Khān, acting out of spite, obeys his kinsman’s word,  
 “‘Farzand Khān, his son, galloped in front of all the army,  
 “‘The man called Ṣamṣāmu-d-daulah, his sword I will splinter ;  
 “‘In battle-field against me who will now venture to stand ?  
 795 “‘At first Chabile Rām attended ‘Izzu-d-din’s court,  
 “‘Then went off to the other side, the wretch, and deceived me,  
 “‘Also ‘Ali Aṣghar Khān came, then marched away to the others,  
 “‘Thought lightly of Mu‘izzu-d-din. Behold their hearts’ !  
 “Saying this he paraded his army, there were five *lakhs* of horsemen,  
 800 “When naming *lakhs*, two lords of elephants count as many thousands,  
 “Then he discharged his cannon, the sky was hidden by smoke,  
 “Earth’s axis yielded, Meru was rent, such was the strength of this army.”  
 Thus wrote Siroman Dās Rāe, ordered it to be carried quickly thither ;  
 The letter-carrier reached the audience-hall of Quṭbu-l-mulk,  
 805 The contents were read aloud clearly by Ṣāhib Rām, Māthur ;  
 Hearing it his eyes reddened, his mind was overcast with rage.  
 Laughing spoke ‘Abdullāh Khān, “That king is very aggressive,  
 “If I now get the auspicious order of the king of kings,  
 “Farrukhsiyar’s good fortune and God’s grace being inseparable,  
 810 “This very day I rush to battle and break the strength of Mu‘izzu-d-din’s arm.”

- On hearing the news he made a resolve, he went the rounds,  
 His retinue having been made ready, the Sayyid rode forth,  
 Joyous, with hand on moustache, he went to see the king,  
 Reported everything, made glad the heart of the king of  
 kings.
- 815 What Mir Jumlah wrote in his report to the Sayyid Wazir,  
 Both were of like contents, the degradation of lord and  
 noble ;  
 The eyes of the World Lord were filled with heroism, the  
 steadfast in battle,  
 His sword trailing at his side, the hero's hand played on his  
 moustache till it bristled,  
 When the lord of all the Bārhaḥs, the hero, Sayyid and  
 Wazir, had told his tale,
- 820 Came Muḥammad Khān, Bangash, and joined with new  
 equipments,  
 Twenty thousand mail-clad horse came, looking like a cloud,  
 All heroes and strong, all hard of heart and hand.  
 Then king Farrukh gave him orders: "I have decided to  
 march,  
 "Muḥammad Khān! parade your men and march at once,  
 825 "To go with you brave fighting nobles and all things are ready,  
 "Arslān Khān has got out the advance tents, and starts to  
 the front this very day."  
 The retinue was made ready, at dawn the king of kings  
 mounted,  
 Then came Muḥammad Khān, verified twenty thousand horse,  
 He was made a *panj-hazārī*, all his officers became *manṣabdārs*,
- 830 They joined the vanguard, the hero hurried to the front.  
 March by march they hurried on, quickly came to Āgrah,  
 Both strong armies drank Jamnā's waters below Bālabhpur,  
 They met face to face on opposite banks, both armies pitched  
 their tents,  
 These wished to cross and attack, those on that side held all  
 paths and passages.
- 835 On both sides the drums resounded, all the waters were  
 moved and trembled,  
 On both sides flags fluttered, the pennants blazed to the stars,  
 The royal tents, lustrous as the cars of the gods, hid out the  
 heavens,  
 Throughout both armies were thousands of brisk movements,  
 the horses stamped their hoofs.

- On both sides handsome tents, like suns and peacocks, delight  
the eye,
- 840 On both sides cannon are fired, keeping up their thunder,  
On both sides all kinds of crash and thump set up all sorts of  
sounds,  
On both sides, night and day, the bullets and rockets fall like  
rain-drops.  
Both sides are full of spirit, with eager desire for the contest,  
Both desired to cross and try their fortune, one constantly  
harassed the other ;
- 845 As they draw near, the armies of the two Dilhī lords leap and  
bound,  
The waves of the great river were restless, the waters grieved  
for both.  
At this time the hero, Sayyid and Wazir, reported as soon as  
he came,  
“ My lord ! Incarnation of Deity ! they have come to tell us of  
firm ground,  
“ Not far to the west of Āgrah, the Jamnā has been forded,  
850 “ It can be forded right across.” Hearing, the king’s heart  
rejoiced.  
They made up a story, spread rumours that Mu’izzu-d-din had  
crossed,  
This was noised on all sides, the strong, bold army made ready,  
Sending some men to face the enemy, the king of kings stood  
ready,  
In the night rushed the Sayyid, then shivering and shaking  
crossed over.
- 855 The army standing in the enemy’s face to bar the way was  
recalled,  
It marched some four *kos*, and for three or four hours halted,  
When the morning dawned, both parties mounted, with music  
playing,  
In great haste the Lord of sword and bow came to the Jamnā  
crossing.  
When the strong, valiant army arrived, the lucky time was  
fixed,
- 860 It was a swift stream, very powerful, full of tricks, hundreds  
of twists and turns,  
The heaven-seated court fixed a bridge on the ocean,  
First they found firm ground through the water, then they  
crossed the stream.

- In this way the king of kings crossed the Jamuā without hindrance,  
 Then next day at dawn, a *kos* or two east of Sikrandah,  
 865 In that place, near the river, the hungry army pitched its tents;  
 Learning their approach, confusion fell on Mu'izzu-d-din's army.  
 Hearing this news, Mu'izzu-d-din's mind was filled with rage,  
 He talked idly, "Friends, behold! now I rush and take him alive,  
 "Not one rebel shall escape, drawing I seize every one,  
 870 "I will torture those who have had the effrontery to join him."  
 So saying he rolled his eyes, drew his dagger from its sheath,  
 Flourishing his sword, trembling with rancour, twisting his moustaches, full of rage,  
 Sheathing every limb in armour, he mounted a war elephant,  
 The deep drums rumbled, in fear and trembling the fixed-pole turned on its axis.  
 875 Five lakhs of fighters followed, filled with eagerness for battle,  
 All clad in hauberk and breast-plate, themselves hard as steel through and through,  
 Thus the heroes passed the night, then marched forward south of Āgrah,  
 Then as morn broke, they hastened to their camp at Sikandrah.  
 The field of battle lay between, the two armies were some two *kos* apart,  
 880 These on the east side, and on the further side from the east in splendour  
 Both heroes shouted with joy, along with their nobles,  
 Then at dawn moved to slay their enemy, like the waves of Jamnā,  
 Wednesday, the full moon of Pūs, *Sambat* seventeen sixty-nine,  
 In the year eleven hundred and thirty-three, the fourteenth of Muḥarram month,  
 885 And of the imperial month Āzar the twenty-third, Çridhar avers,  
 The lucky hour for battle was fixed, the Lord of the World approved it.  
 Then next day for six hours Krishen sent rain in torrents,  
 When the clouds dispersed, the Sun Lord joyfully struck up his drums,

The army followed the hero and noble, the Sayyid Wazīr, as  
 he did this,  
 890 Entirely filled with the joy of battle, he made the first ven-  
 ture into the battle-field.  
 Then the heroes mounted and stood, all the horsemen followed  
 and stood,  
 Wherever troops were needed, thither they were despatched,  
 All the groups advanced, the king's camp was filled like a river,  
 The sun hastened, the tortoise trembled, the snake-king lost  
 his strength.

Bilās Chand (895-999).

895 Receiving the king's orders with shouts,  
 Quṭbu-l-mulk rode to the right,  
 Followed by the steel-clad heroes,  
 Death-dealing and death-receiving warriors.  
 The Sayyid was followed by all the death-dealing warriors,  
 full of efforts,  
 900 On the king's order they drew their swords, shouted, "Strike,  
 Strike," roared hoarsely,  
 Throwing down their reins, full of courage they galloped  
 their horses into the battle,  
 The big drums of 'Abdullāh Khān, the Sayyid, boomed deep  
 and loud to the south.  
 Dilāzāk, Lodi, Lohānī,  
 Pannī, Tarīn, Sūr, Sarwānī,  
 905 Dāūdzāi, Khweshgī, Gabī,  
 Mahmand, Biṭṭānī, Pabī,  
 Biṭṭānī, Pabī, Mattī, Gabī, holding their Arab horses,  
 Clad in breastplate and shirt of mail, full of heart, joint in  
 death or victory,  
 Youthful, bold Pathāns, iron-covered, renders of mountains,  
 in crowds,  
 910 Thus with 'Abdullah Khān advanced the hero Muḥammad  
 Khān, the Bangash.

[ Lines 911-999 deal with episodes in the battle, introducing  
 in each stanza the name of some chief. About twenty-eight  
 men are mentioned, the only verse of special note is one  
 (951-958) bringing in some tribal names :

*Gutrānī, Tarīn, Tīrāhī,*  
*Sarwānī, Mattānī, Enwāhī,*  
*Nassur, Giljī, Kāsab, Kākar,*

*Arab, Sūr, Niānji, Nāgar,  
In front the Bhanār, Kāsi, Āgar, Panī, Ujāgar, Roshānī,  
Mahmand, Biṭṭanī, Jepharmanni (?), Chabi, Lodī, Lohānī,  
Bakhtiyārī, Rohelah, Yūsuf-khailī, Dilāzāk, and Sarwānī,  
These formed the brave array of Zainu-d-dīn Khān, the Dāūdzāi.*

Then the metre changes to *Doharā* (1000–8), and two more names occur, those of the Nāgar leaders. Again from lines 1009–1248 we change to *Kavitta*, the verses being of the same character, the heroes of them being chiefly Chabila Rām, Šamsāmu-d-daulah Khān Daurān, Sādāt Khān and Amīr Khān with their relations and followers. One verse will suffice as a specimen :

- 1109 Delighted, the Pure Master bestowed instantly the whole  
earth's wealth,  
1110 By describing a giver of gold to the needy and wretched you  
name his full titles,  
The big drums of continuous charity beat at his door loud and  
deep,  
Of Mumtāz Khān, the strong, the hero, thus speaks, Çrīdhar  
the Poet.

[ From 1113 to 1248 there are stanzas devoted each to the praise of one man, his relations or followers. The poet exerts himself to give each some special praise but necessarily falls into a good deal of repetition. The metre then changes. ]

Hira Chand (1249–1308).

- 1249 Then Mu'izzu-d-dīn waxed wroth,  
Put on all sides active troops,  
In the vanguard Kokaltāsh Khān,  
Strong, alert, heroic, used to victory.  
[ In a similar manner the names of various nobles are introduced into the next fourteen verses (1253–1308). ]

Harigīta Chand (1309–1464).

- 1309 On both sides the armies were ready, shouting the fighters stood,  
1310 Then beat the kettle-drums on the elephants, the haughty  
north-pole trembled,  
A mist spread, white as milk, the sun's brightness was hid,  
Meru tottered and stooped, its sides moved, its very being  
was threatened.



- On both sides the splendid armies were emulous in the battle-waves,  
 Elephant-pieces, cannon, rockets, often kindled, thundered inexpressibly,  
 1315 Fire-locks raised dust and darkness, both sides fired all their field-pieces,  
 Next spoke uncounted matchlocks, then the faithful fell in heaps,  
 The field-pieces went off "kar, kar, karā, kar," striking with a sharp blow,  
 On all sides the drum-beats rolled, smoke and dust floated, with great heat,  
 Many rockets sped like lightning, the bullets struck like hail,  
 1320 No one's garb could be seen, whether the fighter was of your side or the other.  
 Then the veil of mist lifted, to both sides it was like the dawn,  
 The valiant nobles and heroes shouted, they took their bows in their hands,  
 They galloped onwards, their reins moved like stormy waves,  
 Loud cries arose, "Strike, Strike, Strike," a darkness covered the field.  
 1325 Their arrows flew "tar-tar," rockets hissed "sar-sar," bullets whistled "bhar-bhar,"  
 With foot advanced, onward and onward went many excellent heroes and lords,  
 The valiant with reddened faces, full of joy, the cowards all pallid and trembling,  
 Just as seeing a beggar the generous look happy, the miser, uneasy and displeased.  
 On both sides, in both armies, brave fought with brave most bravely,  
 1330 The scamps were driven off by the valiant forcibly, hero fought with hero,  
 Swords whirled, scimitars were grasped, the heroes cut heads open,  
 With a flash came a wound; how many fell smarting!  
 [Lines 1332-1432, these describe the doughty deeds of each leader, one by one, but do not advance the story.]  
 1433 Death giving and taking, the field-pieces and elephant-guns roared and sounded,  
 There was a tempest of matchlocks, the strong rockets twisted about,

- 1435 There arrows, eager, bewildering, brought to many the hoped-  
for mercy of Paradise,  
The sky-chariot of the sun reached its setting, the time was  
clouded.  
Then hero struggled with hero, with angry looks brave strove  
with brave,  
Cries arose, "Strike, Strike, Strike," shouting they fell in  
heaps,  
The loyal, comely Arabs, the comely heroes, stood fast,  
1440 Where there is meeting and assembly how could they turn  
away their faces.  
[Lines 1441-1452 are devoted to a recital of the names of  
fighters.]  
1453 Everywhere the armies, full of zeal, caused much slaughter,  
Weapons, heavy, two-edged, numerous, fell like torrents of  
rain,  
1455 Chain-mail, vizor, helm were beaten soft, the plates of the  
fish-scales fell off,  
Calling "Strike, Strike," hearing "Stand fast, friend, stand  
fast," they made effort,  
Growling and dark like lowering clouds the proud army moved  
in circles,  
Great drums roared and rattled, drawn swords glanced and  
glittered,  
With a swish fell the arrows, bullet upon bullet came like hail  
at that time,  
1460 A mire of brains collected, when the Sayyid drew his sword.  
He stands full of anger, tossing his head, causing many  
wounds, holding his ground,  
Heads are lost, ears drop, bodies were collected in mounds,  
Blood began to flow in rivers, the stream began to flow on,  
The flesh-rending arrows carried destruction wherever they fell.

Kavita Chand (1465-1576).

- 1465 When waves expand day by day, how can the poet keep count,  
'tis the work of the mad-like fighters,  
To the edge of the snowy hills he drives the invader, who can  
come that he overcomes not at will,  
The well-named leader, the loved lord of prowess, the great  
chief and peerless,  
Of the famous king, Lord Shatrusāl, great, brave, liberal, he  
tells the lustre.

- [1469–1532, Chattarsāl, Muṣliḥ Khān and some others are introduced. We draw near to the end of the battle.]
- 1533 King Farrukhsiyar and Jahāndār Shāh both fought for the throne in front of Āgrah,  
The conqueror beats his drums, the defeated fled, the warriors forgetting all turned their bridle-reins,
- 1535 Resolutely, verily diverting rivers, did A'zam Khān, strong and loyal, uphold the cause of his king,  
As in the Mahābhārat the weak king was chased away by Bhīm, strong of arm, at Kurukhet.  
[Lines 1537–1544 give the praises of A'zam Khān.]
- 1545 To see Farrukhsiyar, the conqueror, full of delight at Mu'izzu-d-dīn's defeat,  
Beating drums, turning his reins, came Chabila Rām  
[Māri par dal har khāyo jūth jogini ko karat baḍāi siwā saṅkar hilākh hai]  
One hero many thousands has slain in one moment, counting them one.  
[Lines 1549–1576 relate various phases of the fighting, and introduce the names of many leaders. A *dohā*, 1577-78 is of the same nature.]

Kavita (1579–1632).

- [Lines 1579–1598 are mere catalogues of names.]
- 1599 A festival of joy and gladness heightened the delight of all, the colour of things had brightened,
- 1600 Thy reign adds lustre to sovereignty, the fruit of fortune and felicity;  
The happily-named king of kings, Farrukhsiyar, the man of the lucky star,  
In his day the throne was adorned, when he sat on the throne, the good fortune of that throne was enhanced.  
Shaking the south, conquering west and east, this unparalleled man has come with strong hand,  
The fortunate king of kings, Farrukhsiyar, has brought the seven isles within the realm of Hind,
- 1605 Daily he increases, also the Faith, he has extended his sovereignty over faith and the world,  
When a king is adorned with sovereignty, he should thus obtain it.  
His horsemen herded them like a flock of sheep, the army rent, he robbed the nest of A'azzu-d-din,

Rushed from the east, scared away like starlings the army of  
the pretender, Mu'izzu-d-din,

The fortunate king of kings, Farrukhsiyar, defender of the  
two faiths;

1610 From realm to realm ran the news of victory, the haughty  
feared, the humble were enraptured,

Some pod, some pea free from weevil, some one not the slave  
of a harlot,

Handsome, graceful, brave, excellent, young, a man beyond  
compare,

Fortunate, a second King Akbar, has Farrukhsiyar obtained  
sovereignty,

He wields sovereign strength, to see him is delight, wearing  
the garland of victory.

[The remaining lines are devoted to Najmu-d-din 'Alī Khān,  
Sayyid Anwar Khān, Sarbuland Khān, and Mir Mushrif,  
ending with line 1630.]

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NOTES.

Line 18, the allusion is to 'Azīmu-*sh-shān*, Farrukhsiyar's father.—l. 145, *ādam* for *āmad*, (Persian) "coming, approach,"—l. 394. This is the 'Id of the 1st Shawwāl, 1124 H.=31st Oct., 1712. According to Kāmwar Khān, the prince observed the 'Id on the right bank of the Ganges, opposite Benares, and crossed the river on the 2nd Shawwāl. Farrukhsiyar was at Jhūsī on the 13th (12th November, 1712)—ll. 411, 413, Kumwarpur and Binduki are both named by Kāmwar Khān; Fathābād is probably a name for Kajwah—l. 422. The "battle-pillar" is possibly an allusion to the *van-khambh*, a wooden post said to have stood in the midst of the Kurukhet at Thānesar—l. 615, I have failed to make anything of this line—l. 706, "hand" = *panjah*, the figure of an open hand, one of the honorary distinctions granted by the Emperors—l. 744, *Sāmchuhai*, "the true one," a Hindi equivalent of the epithet *Ṣādiq*, borne by Luṭfullāh Khān, in token of his descent from one of the twelve Imāms, Ja'faru-ṣ-ṣādiq.—l. 780, *Surani*, a long horn, to the sound of which a dog's howling may well be likened. ll. 883-85. Not only do these dates seem wrong, but they are hopelessly irreconcilable with each other. If we take the day of the week, Wednesday, as correct, then the battle was fought on the 11th January, 1713, N.S., which by the usual computation agrees with the 13th Zu'l-Hijjah 1124 H., the date given by the historians. The 14th Muḥarram (1125) was a Thursday or Friday, not a Wednesday. As for

the *teisā* (33) of the text, this may be a clerical error for *teisā* (23); but the latter year (1123 H.) is equally impossible, for Bahādur Shāh did not die till the 21st Muḥarram, 1124 H., more than a year afterwards. Then the *Sambāt* year 1769 began, according to Cunningham's tables, on the 28th March, 1712, and Pūs pūranmāsi, being the 230th day, comes out as the 1st January, 1713 (3rd Zu'l-Ḥijjah 1124 H.), or ten days too early. Nor does the poet's Mahomedan date, 14th Muḥarram, agree, as will be seen, with this *Sambāt* date. So with the Ilāhi era. Āzar being the 9th month, and the year beginning on the 20th March, the 23rd of that month is the 270th day of the year, equivalent to the 15th December, 1712, agreeing neither with the Hijra nor *Sambāt* date. I make out the synchronism, to be, 13th Zu'l-Ḥijjah 1124 H. = 22nd Day of the Ilāhi era = S. 1769, Māgh badi 10th = 11th January, 1713.\* *Khāfi Khān*, II, 721, has 13th Zu'l-Ḥijjah = 19th Day.—1.905, 906, I am not sure whether *Gabī* is a tribal name, or a mere epithet used to fill out the line. The Pabbi are a sub-division of the Afridis, see "Dictionary of the Pathan Tribes," Calcutta, 1899.—1. 1547, I can make nothing out of this line.

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\* [By Prof. Jacobi's Tables, published in *Epigraphia Indica*, Vol. i, pp. 443 ff., I find that *Samvat 1769*, full-moon day of Pūs fell on Wednesday, 11th January, 1713, N.S., as required. *Māgha vadi 10* corresponds to Sunday, 22nd January, 1713, N.S., according to the *pūrṇimānta* scheme of lunar fortnights, or to Monday, 20th February, 1713, N.S., according to the *amānta* scheme of lunar fortnights.—Ed.]

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*A New Copper-plate Inscription of Lakṣmaṇasena.*—By BABU AKṢHAY  
KUMAR MAITRA, B.L.

[Read, June 1899.]

The copper-plate — bearing this Inscription, was discovered in the month of Bhādra 1898, in the village of Anulia, near Ranaghat, in the District of Nadia. It has been edited previously in my journal, the *Aitihāsika Citra*, by Pandit Rajanikanta Cakravartti of Maldah. I now re-edit it from the original plate.

The plate measures  $13\frac{1}{4}$ " by  $12\frac{1}{2}$ " and bears on both sides a Sanskrit Inscription in 56 lines partly in prose and partly in verse. The writing is of the Bengali variety of the North-East Indian Alphabet of the 12th century and intimately agrees with the characters of the other well-known documents of the Sena Dynasty. The spelling is on the whole very correct, and no remarks as to orthography are called for. The seal, bearing the image of a ten-armed deity, is attached to the top of the plate.

The Inscription opens with the words *Om! Namo Nārāyaṇāya*, and an invocation to Çambhu and the Moon, after which the well-known genealogy of the Sena Kings from Hemanta to Lakṣmaṇasena is recorded in exactly the same words as in the Tarpan Dighi Plate,<sup>1</sup> but with this exception only that instead of verse VIII of the Tarpan Dighi Plate, three other verses are added (ll. 18–24) in praise of the liberality and bravery of Lakṣmaṇasena, which, however, do not mention a single historical fact.

The object of the Inscription is to record a grant made by *Lakṣmaṇasena*, who is styled as *Parameçvara-Paramavaiṣṇava-Paramabhaṭṭāraka-Mahārājādhirāja* and who is described as meditating over the feet of *Mahārājādhirāja-çri-Vallālasena*. The grant was made

<sup>1</sup> Edited in *this Journal*, Vol. XLIV, for 1875, Part I, pp. 1–15, with two facsimile Plates. Another copper-plate of Lakṣmaṇasena has been discovered last year at Madhainagar, near Serajganj, in the Pabna District. It is, however, yet unedited.

by him while he was staying at his camp in *Vikramapura* (ll. 27 ff.), and consisted of a portion of a field in *Matharaṇḍiyā* (*Mātharaṇḍiyā-khaṇḍa-kṣetra*; l. 38) which is described as lying in *Vyāghrataṭi*, a place or district belonging to the *bhukti* of *Paṇḍravarārdhana* (ll. 37 ff.). This piece of land was given to a Pandit, *Raghudevaçarmman* by name, the son of *Devadāsadevaçarmman* and grandson of *Çaṅkaradevaçarmman*, and great-grandson of *Vipradāsadevaçarmman*, who belonged to the *Kauçika-gotra*, and studied the *Kāṇva-çākhā* of the Yajurveda (ll. 70 ff.).

The grant was made on the 9th day of Bhādra, in the 3rd year of Lakṣmaṇasena's reign (l. 56). This date taking the year 1119 A.D., the epoch of the Lakṣmaṇasena Era, as the beginning of his reign, corresponds to A.D. 1121-22. The Minister for piece and war, *Nārāyaṇa-datta*, acted as *dūtaka* (ll. 54-55).

Historically we gather no new information from this inscription. I am unable to identify the exact position of the localities mentioned in the grant.

I now edit the Inscription from the original Plate :—

*Obverse:*

- (l. 1,) Om̐ namo.Nārāyaṇāya || Vidyud<sup>1</sup>=yatra maṇi-dyutiḥ phaṇi-pater=vvā(bbā)lendu=indr-āyudham̐ vāri
- (l. 2,) svargga-taraṅgiṇi sita-çiro-mālā valāk-āvaliḥ | dhyān-ābhyāsa-samiraṇ-opani-
- (l. 3,) hitaḥ çreyo-ṅkur-odbhūtaye bhūyād=vaḥ sa bhav-ārṭti-tāpa-bhiduraḥ Çambhoḥ kapardd-āmvu(mbu)daḥ ||
- (l. 4,) Ānando=mvu(mbu)-nidhau cakora-nikare duḥkhaçchid=ātyantiki kalhāre hata-mohatā Rati-
- (l. 5,) patāv=eko=ham=ev=eti dhiḥ | yasy=āmī amṛt-ātmanaḥ samudayanty=āçu prakāçāj=jagaty=A-
- (l. 6,) trer=dhyāna-paramparā-pariṇatam̐ jyotis=tav=āstām=mude || Sev<sup>2</sup>-āvanamra-nṛpa-koṭi-kiri-
- (l. 7,) ṭa-rocir-amv(mb)-ūllasat-pada-nakha-dyuti-vallaribhiḥ | tejo-viṣa-jvara-muṣo dviṣatām=a-
- (l. 8,) bhūvan bhūmibhujah̐ sphuṭam̐=ath=ausadhi-nātha-vam̐çe || Ā<sup>3</sup>-kaumāra-vikasvarair=ddiçi di-
- (l. 9,) çi prasyandibhir=ddor-yaçaḥ-prāleyai ripu-rāja-vaktra-nalina-mlāniḥ samuumilayan | He-
- (l. 10,) MANTAḤ sphuṭam̐=eva Sena-janana<sup>4</sup>-ksetr-augha-puṇy-āvali-çāli-çlāghya-vipāka-pivara-guṇas=te-

<sup>1</sup> Metre: Çārdulavikriḍita; and of the next verse.    <sup>2</sup> Metre: Vasantatilakā.

<sup>3</sup> Metre: Çārdulavikriḍita.

<sup>4</sup> The second *na* has been inserted later.

- (1. 11.) śām=abhūd=vaṁṣajah || Yadiyair<sup>1</sup>=ady=āpi pracita-bhuja-  
tejas-sahacarair=yaçobhiḥ çobhante
- (1. 12.) paridhi-pariṇadhlā iva diçah | tataḥ kāñci-lilā-catura-catur-  
ambhodhi-lahari-parit-orvvi-
- (1. 13.) bharttā=jani VIJAYASENAḤ sa vijayi || Pratyūhaḥ<sup>2</sup> kali-  
sampadām=analaso vedāya naik-ādhvagaḥ
- (1. 14.) saṅgrāmaḥ çrita-jaṅgam-ākrtir=abhūd=VALLĀLASENAS=tataḥ |  
yaç=cetomayam=eva çaurya-vijayi
- (1. 15.) da[\*]tv=auśadham tat-kṣaṇād=akṣiṇā racayāñ=cakāra  
vaçagāḥ svasmin pareṣām çriyah || Sambhukt-ā-
- (1. 16.) nya-dig-aṅganā-gaṇa-guṇ-ābhoga-pralobhād=diçām=içair=  
amça-samarppaṇena ghaṭitas=tat-tat-prabhāva-sphu-
- (1. 17.) taiḥ | dor-uṣma-kṣapit-āri-saṅgara-raso rājanya-dharmm-  
āçrayaḥ çrimal-LAKṢMAṆASENA-bhūpatir=a-
- (1. 18.) taḥ saujanya-simā=jani || Āmnāyaḥ praṇināya yāni munayo  
yāny=asmaran samstutāny=ā-
- (1. 19.) cāreṣu ca yāni tāni dadire dānāni dainya-druhā | hriṇattvo  
ca tathā=py=anena niyamaṁ kā-
- (1. 20.) leṣu samkhyātātān=deyeṣv=artthinam=antareṇa ca phal-  
āçamsā-vidhau çrṇvatā || Samayam<sup>3</sup>=api sa-
- (1. 21.) muddhatam numas=tam tad-asi-mah-auśadham=udva(dba)-  
bhūva yatra | bhavati para-pura-praveça-siddhiḥ kara-vi-
- (1. 22.) dhṛte sakṛd=eva yasya mūle || Yān<sup>4</sup> samva(mba) ndhya  
jagat-trayi-vitarane mittrair=Vva(Bba)lir=vvāritoyaiḥsa-
- (1. 23.) ṅgamyā na Gaṅgayā kṣaṇam=api svarggo=pi samsmaryate |  
tān=uçcāir=atiçāyi-çāli-vasudhān=ā-
- (1. 24.) rāma-ramy-āntarān=viprebhyo=yam=adatta pattana-gaṇān  
bhūmīpatir=vbhū (bbhū)yasa(ça)ḥ || Sa khalu çri-Vi-
- (1. 25.) KRAMPURA-samāvāsita-çrimaj-jaya-skandhāvārāt | Mahārājā-  
dhirāja-çri-VALLĀLASENA-
- (1. 26.) DEVA-pād-ānudhyāta-Parameçvara-Paramavaiṣṇava-Pa[ra\*]-  
mabhaṭṭāraka-Mahārājādhirāja-çrima-
- (1. 27.) I-LAKṢMAṆASENADEVAḤ kuçali samupagat-āçeṣa-rāja-rājanya-  
ka-rājñi-rāṇaka-rājapu-
- (1. 28.) tra-rājāmātya-purohita-mahādharmmādhyakṣa-mahāsān-  
dhivigrahika-mahāsenāpati-

Reverse :

- (1. 29.) mahāmudrādhikṛta-antarāṅgavṛ(bṛ)haduparika-mahākṣa-  
paṭalika-mahāpratihāra-mahā-

<sup>1</sup> Metre : Çikharinī.

<sup>2</sup> Metre : Çārdūlavikṛḍita; and of the next two verses.

<sup>3</sup> Metre : Puṣpitāgrā.

<sup>4</sup> Metre : Çārdūlavikṛḍita.

- (1. 30,) bhogika-mahāpilupati-mahāgaṇastha-daussādhika-caurod-  
dharanika-nau-va (ba)la-ha-
- (1. 31,) sty-açva-go-mahiç-ājāvik-ādi-vyāpṛtaka-gaulmika-daṇḍapa-  
çika-daṇḍanāyaka-viça-
- (1. 32,) yapaty-ādin | anyāmç=ca sakala-rāja-pādopajivino s dhyakṣa-  
pracār-oktān=iḥ=āki-
- (1. 33,) rttitān | caṭṭa-bhaṭṭa-jātiyān janapadān | kṣetrakarāmç=ca  
vrā(brā)hmaṇān vrā(brā)hmaṇottarān yathā-
- (1. 34,) rham mānayati vo(bo)dhayati samādiçati ca | matam=astu  
bhavatām | yathā çrī-PAUṆPRAVAEDDHANA-bhukty-antaḥ-
- (1. 35,) pāti-VYĀGHRATAṬṬĪM | pūrvve açvattha-vṛkṣaḥ simā | dakṣiṇe  
jala-pillā simā | paçcime Çā-
- (1. 36,) ntigopi-çāsanam simā | uttare mālāmañca-vāṭi simā | ittham  
catuḥ-sim-āvacchinnam vṛṣabha-ça-
- (1. 37,) ṅkara-nalina-sakākinika-sapta-trimṣad-unmāu-ādihik-ādh-  
āvāp-ānrita-nava-droṇ-ottara-bhū-pāṭa-
- (1. 38,) k-aik-ātmakam samvatsareṇa kaparddaka-purāṇa-çat-aik-  
otpattikam MĀTHARAṆḍIYĀ-KHAṆḍA-KṢETRAM sa-jhā-
- (1. 39,) ṭa-vitapam<sup>1</sup> sa-jala-sthalam sa-garitt-oçaram sa-guvāka-  
nārikelam sahya-daç-āparādham paribṛta-sarvva-
- (1. 40,) pīdam a-caṭṭa-bhaṭṭa-praveçam a-kiñcit-pragrālyam ṭṛṇa-  
yūti-gocara-paryantam VIPRADĀSADEVA-
- (1. 41,) ÇARMAṆAḤ prapauttrāya ÇAṆKARADEVAÇARMAṆAḤ pauttrāya  
DEVADĀSADEVAÇARMAṆAḤ puttrāya Kau-
- (1. 42,) çika-sagotrāya Viçvāmītra-Va(Ba)ndhula-Kauçika-prava-  
rāya Yajurvveda-Kāṇva-çākh-ādhyāyi-
- (1. 43,) ne Paṇḍita-çrī-BAGHUDEVAÇARMAṆE puṇye s hani vidhivad-  
udaka-pūrvvakam Bhagavantam çrīman-Nā-
- (1. 44,) rāyana-bhaṭṭarakam=uddiçya mātāpitror=ātmanaç=ca puṇya-  
yaço s bhivṛddhaye<sup>2</sup> utṣṛjya ā-
- (1. 45,) candr-ārkkam kṣiti-sama-kālam<sup>3</sup> yāvat bhūmi-cchidra-  
nyāyena tāmraçāsani-kṛtya pradattam=asmā-
- (1. 46,) bhīḥ | Tad=bhavadbhīḥ sarvvair=ev=ānumantavyam | Bhāvi-  
bhir=api nṛpatibhir=apaharāṇe nara-
- (1. 47,) ka-pāta-bhayāt pālāne dharmma-gauravāt pālaniyam |  
Bhavanti c=ātra dharmm-ānuçam-
- (1. 48,) sinaḥ çlokāḥ | Bhūmim<sup>4</sup> yaḥ pratigṛhṇāti yaç=ca bhūmim  
prayacchati | ubhau<sup>5</sup> tau puṇya-

<sup>1</sup> This reading has been first pointed out by Prof. Kielhorn in *Epigraphia Indica*, Vol. V, p. 185, note 1. <sup>2</sup> Read *puṇya-yaço-bhivṛddhaye*, without *avagraha* sign.

<sup>3</sup> Read *ā-candr-ārka-kṣiti-sama-kālam*. <sup>4</sup> Metre: Anuṣṭubh (Çloka); and of the next two verses. <sup>5</sup> The letter *u* has been added later.

- (1. 49,) karmmāṇan niyataṁ svargga-gāminau || Sva-dattāṁ para-  
dattāṁ=vā yo hareta va-
- (1. 50,) sundharāṁ | sa viṣṭhāyāṁ kṛmir=bhūtvā pitṛbhis=saha  
pacyate || Āsphotayanti
- (1. 51,) pitaro valgayanti pitāmahāḥ | bhūmi-dātā kule jātas=sa nas=  
trātā bhavi-
- (1. 52,) śyati || Iti<sup>1</sup> kamala-dal-ām(vu)-vindu-lolāṁ Āriyam=  
anucintya manuṣya-jīvitāṁ ca |
- (1. 53,) sakalam=idam=udāhṛtaṁ ca vuddhā(buddhvā) na hi  
puruṣaiḥ para-kirttayo vilo-
- (1. 54,) pyāḥ || Ārimal<sup>2</sup>-Lakṣmaṇaseno NĀRĀYAṆADATTA-Sāndhivigra-  
hikam |
- (1. 55,) Raghudevaçāsane skṛta dūtaṁ bhū-maṇḍali-va(ba)la-  
bhīḥ ||
- (1. 56,) Saṁ 3 Bhādra-dine 9 mahāsāṁ ni || çṛini<sup>3</sup> ||

<sup>1</sup> Metre: Puspitāgrā.

<sup>2</sup> Metre: Āryā.

<sup>3</sup> *Mahāsāṁ ni* probably is an abbreviation for *mahāsāṁdhivigrahikena nibaddham.*

The last two syllables perhaps are the king's endorsement of the document.

*The Manahali Copper-plate Inscription of Madanapāladeva.—*

By BABU N. N. VASU.

[Read, March 1899.]

The subjoined edition of a new inscription of Madanapāladeva has been prepared from a copper-plate kindly presented to this Society in 1899 by Mr. N. K. Bose, C.S., then Magistrate of Dinajpur. The plate on which the inscription is engraved, was discovered in excavating a tank in 1875 within a park of the village of Manahali,<sup>1</sup> in District Dinajpur, Bengal.

The Inscription consists of 58 lines of writing, engraved on the two sides of a single copper-plate, measuring  $15\frac{3}{4}$ " by 16". At the top of the plate the SEAL is soldered on. It shows the usual emblem of the Pāla kings, *viz.*, the Buddhistic wheel of Law with a deer kneeling on each side, facing it. Below this we may still recognize the king's name: *Çri-Madanapālah*, and on the top of the seal traces of small Stūpa are still visible. The WRITING belongs to the Bengali variety of the Nāgari Alphabet of about the 12th century; as compared with the earlier inscriptions of the Pāla Dynasty, it shows a marked development towards more modern forms. Its execution is on the whole done fairly well; in one place, however, it has been impossible to make out exactly the meaning of the letters; unfortunately, this passage contains the name of the village, granted by the king (ll. 32-33). The *avagraha* sign is frequently used in this inscription; final letters are marked by the sign of *virāma*, which, however, seems to have been left out by carelessness in some instances, where in order to avoid unnecessary corrections in the subjoined transcript the letter has been put down as final. In regard to ORTHOGRAPHY, I desire to draw attention to the spelling *ttajan*, for *tyajan* in l. 14; *prattar̥thi*, for *pratyar̥thi* in l. 24; and also *puṇair*, for *puṇyair* in l. 16. Instances of this kind may be taken as originating from a pronunciation of the compound letters *tya* and *ṇya*,

<sup>1</sup> The "Munhlee" of the Indian Atlas, sheet No. 119, 6 miles south of Deokot; Long. 88° 35' E.; Lat. 25° 19' N.



which almost closely resembled the modern Bengali pronunciation of the same. The LANGUAGE is Sanskrit, and with the exception of the introductory benediction (in line 1) and the portion containing the grant (lines 27-49), it is in verse. At the top of the inscription, we find the letter *ni* engraved four times in one line; this appears to be the official endorsement of the document, *ni* probably being an abbreviation of the term *niḥaddham* used in similar cases.

The INSCRIPTION divides itself into :—

(a) a genealogical portion, in verse, giving the names of 19 princes of the Pāla family of Magadha, 17 of which appear to have been reigning kings (ll. 1-27);

(b) the portion containing the grant, in prose (ll. 27-49);

(c) the usual benedictive and imprecatory verses; this portion ends with the mention of the name of the person who acted as *dūtaka* and of the engraver; it is in verse throughout (ll. 49-58).

With reference to the GENEALOGY OF THE PĀLA KINGS as recorded in this Inscriptions, I need merely point out that up to Vighrahapāla III. it almost verbally agrees with the corresponding passage in the Amgachi Plate (*Indian Antiquary*, Vol. XXI, p. 100). The only notable difference is that the verses beginning with *yañ svāmināñ rājagunair-anūnam* (ll. 13-14), and with *deṣe prāci pracura-payasi* (ll. 19-21) have been left out in this Inscription. I may also note that by the reading of this Inscription it is now possible to correct the passage read doubtfully as *viṣva-priye* in l. 15 of the Amgachi Plate and in l. 20 of the Dinajpur Plate of Mahipāla (*this Journal*, Vol. LXI, 1892, Part I, p. 83); the corresponding passage in the present Inscription (l. 13) distinctly reads *netra-priye*, which appears to be the correct reading. From Vighrahapāla III., onwards, we then have the following succession of kings :—

- (1) MAHIPĀLA II., son of Vighrahapāla III., (l. 18);
- (2) ĀURĀPĀLA, son of Vighrahapāla III., and younger brother of Mahipāla II., (l. 20);
- (3) RĀMAPĀLA, another son of Vighrahapāla III., and brother of Mahipāla II., and of Āurapāla (l. 21);
- (4) KUMĀRAPĀLA, son of Rāmapāla (l. 23);
- (5) GOPĀLA III., son of Kumārapāla (l. 24);
- (6) MADANAPĀLA, son of Rāmapāla and Madanadevi (l. 26).

The portion of the inscription giving the pedigree of these six kings, appears to be corrupt in some passages, and is not entirely intelligible to me. As, however, no real historical facts are mentioned in those verses, I trust that I will be excused in refraining myself from giving a translation. I merely wish to point out here, that the names

of the first two kings, Mahipāla II., and Ćurapāla, have been made known to us for the first time only very recently in a notice on the *Rāmacarita*, a poetical biography of Rāmapāla, discovered by my learned friend, Mahamahopadhyaya Haraprasad Shastri, and published in the *Proceedings of this Society*, March 1900, p. 70 ff. They are omitted in the pedigree of Pāla kings, occurring in the Kamauli Plates of Vaidyadeva of Prāgjyotiṣa (*Epigr. Indica*, Vol. II, p. 350), from which record we have been already acquainted with the names of their two successors, Rāmapāla and Kumārapāla. Of Madanapāla, we possess a short dedicatory inscription, dated in his 19th year, while the name of Gopāla III., his nephew and predecessor on the Pāla throne, is entirely new to us. As to Madanapāla's time, I can only say that I believe him to have lived in the first half of the 12th century A.D.

The grant made by him on the occasion of his queen, the Paṭṭamahādevi Citramatikā, consisted of a village perhaps named Kāṣṭhāgiri, lying in the Koṭivarṣa-*viṣaya*, and belonging to the Pauṇḍravardhana-bhukti. It was given to a Brahman, Vateṣvarasvāmiṣarman, son of Ćaunakasvāmin, grandson of Prajāpatisvāmin, and great-grandson of Vatsasvāmin, an inhabitant of Campāhiṭṭi, student of the Kautthuma Ćākhā of the Sāmaveda, fellow-student of Bhūṣaṇa, and belonging to the Kautsa Gotra and Ćāṇḍilya-Asitadevala Pravara (ll. 42-45). The village was given to him as a *dakṣiṇā*, after having read the Mahābhārata for the benefit of the Queen. The passage recording this fact, is of peculiar interest; it reads (l. 45 ff.): *Paṭṭamahādevi-ṣrī-Citramatikayā Vedavyāsa-prokta-prapāḥita-Mahābhārata-samutsarjita-dakṣiṇātvēna Bhagavantam Buddha-bhaṭṭārakam=uddiṣya ṣaṣaṇī-kṛtya pradatto s smābhīḥ*. The order confirming the grant was issued from the royal camp at Rāmāvati, situated on the banks of the Ganges (l. 30). It was given in the king's 8th year, on the 15th lunar day of Caitra (ll. 49 and 57). The minister of peace and war, Bhimadeva, acted as *dūtaka* (l. 57). The engraver's name was Tathāgatasara (l. 58). With the exception of the Pauṇḍravardhana-bhukti and the Koṭivarṣa-*viṣaya*, the names of the localities mentioned in this inscription are new to us; I am unable to identify any of them.

I now edit the Inscription from the original plate.

*The Seal :*

(ĆRI-MADANAPĀLAḤ.)

*The Plate. Obverse :*

(l. 1.) Om̐ namo Vu(Bu)ddhāya Ṇ Svasti Ṇ Maitrīm<sup>1</sup> kāruṇya-ratna-pramudita-hṛdayaḥ prayasim̐ sandadhānaḥ samyak-

<sup>1</sup> Metre Sragdharā.

- samvo(mbo)dhi-vidyā-sarid-amala-jalaḥ(la)-kṣāli-
- (1. 2,) t-ājñāna-paṅkaḥ | jitvā yaḥ kāma-kāri-prabhavam=abhibhavaṁ śāçvatām(tim) prāpa çānti(utim) sa çrimān lokanātho jayati Daçava(ba)lo s nyaç=ca GÖPĀLADEVA-
- (1. 3,) ऋ ᳚ Lakṣmī<sup>1</sup>. jauma-niketanaṁ sama karo vodhu[m\*] kṣamaḥ kṣmābharaṁ pakṣa-ccheda-bhayād=upasthitavatām=ek-āçrayo bhūbhṛtām | maryādā-paripālan-aika-ni-
- (1. 4,) rataḥ çaurya-ālayo s smād=abhūt dugdh-āmbhodhi-vilāsa-hāsa-vasatiḥ çri-DHARMAPĀLO nṛpaḥ ᳚ Rāmasy=eva grhita-satya-tapasas=tasy=ānurūpo guṇaih
- (1. 5,) Saumitrer=udapādi tulya-mahimā VĀKPĀLA-nām=ānujñah [t\*] yaḥ çrimān naya-vikram-aika-vasatir=bhrātuh sthitaḥ çāsane çūnyāḥ çatru-patākinibhir=a-
- (1. 6,) karod=ek-ātpatro<sup>2</sup> diçah ᳚ Tasmād<sup>3</sup>=Upendra-caritair=jaga-tim punānaḥ putro va(ba)bhūva vijayi JAYAPĀLA-nāmā | dharmma-dviṣām çamayitā yudhi DEVAPĀLE yaḥ pū-
- (1. 7,) rvva-je bhuvana-rājya-sukhāny=anañiṣit ᳚ Çrimad<sup>4</sup>. VIGRAHA-PĀLAS=tat-sūnur=Ajātaçatruḥ=iva jātah | çatru-vanitā-prasādhana-vilopi-vimal-āsi-jala-dhārah ᳚
- (1. 8,) Dik-pālaih<sup>5</sup> kṣiti-pālanāya dadhataṁ dehe vibhaktān guṇān çimantaṁ jauayām=va(ba)bhūva tanayaṁ NĀRĀYAṆAM sa tābhūm<sup>6</sup> | yaḥ kṣoṇi-patibhiḥ si(çi)romaṇi-rucā=
- (1. 9,) çliṣṭ-āṅghri-piṭh-opalaṁ nyāy-opāttam=alañ-cakāra caritaih svair=eva dharmm-āsanam ᳚ Toy-āçayair<sup>7</sup>=jjaladhi-mūla-gabhīra-garvbhai(rbbhai)r=dev-ālayaiç=ca kula-bhū-dhara-
- (1. 10,) tulya-kakṣaih[|\*]vikhyāta-kīrti(rtti)r=abhavat=tanayaç=ca tasya çri-RĀJYAPĀLA iti madhyama-loka-pālah ᳚ Tasmā-[t\*]<sup>8</sup>=pūrvva-kṣitidhrān=nidhir=iva mahasām RĀṢṬRA-
- (1. 11,) कृत्-ānvay-e[n\*]dos=TUṆGASY=ottunga-mauler=duhitari tanayo BHĀGYADEVYĀM prasūtaḥ | çrimān GÖPĀLADEVAÇ=cirataram=avaner=eka-patnyā iv=ai-
- (1. 12,) ko bharttā=bhūn=n-aika-ratna-dyuti-khacita-catuḥ-sindhu-citr-āṅgu(mçu)kāyāḥ ᳚ Tasmād<sup>9</sup>=va(ba)bhūva savitur=vvasu-koṭi-vardhi kālena candra iva VIGRAHAPĀLA-
- (1. 13,) DEVAḤ | netra-priyeṇa vimalena kalāmayena yen=oditena

<sup>1</sup> Metre Çārdūlavikrīḍita; and of the next verse.

<sup>2</sup> Read *ekātapatro*.

<sup>3</sup> Metre Vasantatilakā.

<sup>4</sup> Metre Āryā.

<sup>5</sup> Metre Çārdūlavikrīḍita.

<sup>6</sup> Read *prabhūm* with the Amgachi and Dīvajpur plates.

<sup>7</sup> Metre Vasantatilakā.

<sup>8</sup> Metre Sragdharā.

<sup>9</sup> Metre Vasantatilakā.

dalito bhuvanasya tāpaḥ || Hata<sup>1</sup>-sakala-vipakṣaḥ saṅgare  
vā(bā)hu-darpā(d<sup>2</sup>=a)nadhi-

- (1. 14,) kṛta-viluptam rājyam=āsādyā pitryam | nihita-carāṇa-padmo  
bhūbhṛtām mūrdhni tasmād=abhavad=avaupālah ṣṛi-  
MAHĪPĀLADEVAḤ || Ttajan<sup>3</sup> yo-
- (1. 15,) ṣ-āsangam ṣirasi kṛta-pādaḥ ksitibhṛtām vitanvan sarvv-  
āḥḥ prasabham=uday-ādrer=iva raviḥ | guṇa-grāmyā<sup>4</sup>  
snigdha-prakṛtir=anurāg-ai-
- (1. 16,) ka-vasatis=tato dhanyaḥ puṅ[y\*]air=aḥjani NAYAPĀLO nara-  
patiḥ || Pitah<sup>5</sup> saḥ-jana-locanaiḥ Smara-ripoḥ pūjā-nu-  
raktaḥ sadā smgrāme dha-
- (1. 17,) valo=dhika-grahakṛtām<sup>6</sup> kālāḥ kule vidviṣām | caturvvaru-  
ya-samācṛayāḥ sita-yaḥḥ-pūraiḥ=jagala=lambhayan tas-  
mā-d=VIGRAHAPĀLADEVA-NṚ-
- (1. 18,) patiḥ puṅyair=jjanānām=abhūt || Tan-ṇandanaḥ=candana-  
vāri-hāri-kirtti-prabh-ānandita-viṣva-gitaḥ | ṣṛimān=  
MAHĪPĀLA iti dvitīyo
- (1. 19,) dvij-ēca-mauliḥ Ṣiva-vad=vā(ba)bhūva || Tasyā<sup>8</sup>=bbūd=  
anuḥo Mahendra-mahimā kandaḥ prātāpa-ṣṛiyām=ekāḥ  
sāhinsa-sārathir=guṇa-na(ma)yaḥ
- (1. 20,) ṣṛi-ṢURAPĀLO nṛpaḥ [1\*]yaḥ svacha(ēcha)nda-nisargga-  
vibhrama-bharā[n\*] vivbhra(bibbhra)t sarvv-āyudha<sup>9</sup>  
prāgalbhyena manaḥsu vismaya-bhayaṁ sadyas=tatāna  
dviṣām || E-
- (1. 21,) tasyā=pi sahodaro narapatiḥ=ddivya-prajā-nirvha(rbbha)ra-  
kṣobh-āhūta-vidhūta-vāsava-dhṛtiḥ ṣṛi-RĀMAPĀLO ṣ bha-  
vat | ṣāsaty=eva
- (1. 22,) ciraṁ jaganti janake yaḥ ṣaiṣave visphurat-tejobhiḥ para-  
cakra-cetasi camat-kāraṁ cakāra sthiraṁ || Tasmād<sup>10</sup>=  
ajāyata nij-ā-
- (1. 23,) yata-vā(bā)hu-vīrya-nispi(ṣpi)ta-pivara-virodhi-yaḥḥ-  
payodhiḥ | medasvi-kirttir=amar-endra-vadbū-kapola-  
karppūra-pattra-makari sa KU-

<sup>1</sup> Metre Mālinī.

<sup>2</sup> The akṣara *da* has been added later; it looks rather like the *avagraha* sign.

<sup>3</sup> Metre Cikhariṇī. Read *Ttajan doṣāsaṅgam* with the Amgachi plate.

<sup>4</sup> Read *guṇ-āgrāmyaḥ*; the Amgachi plate here reads *hata-dhvāntaḥ*.

<sup>5</sup> Metre Ṣārdūlavikṛidita.

<sup>6</sup> Read *caturo = dhikaṁ ca Haritaḥ* with the Amgachi plate.

<sup>7</sup> Metre Upajāti.

<sup>8</sup> Metre Ṣārdūlavikṛidita; and of the next verse.

<sup>9</sup> Read *sa-sarvv-āyudhān*.

<sup>10</sup> Metre Vasantatilakā.

- (1. 24,) MĀRAPĀLAḤ || Pratta(tya)rtthi <sup>1</sup>-pramadā-kadamva(mba)-  
ka-çirah-sindūra-lopa-krama-kriḍā-pāṭala-pāṇir-eṣa suṣ-  
uve GOPĀLAM=ū(n)rvvi-bhujam |
- (1. 25,) dhātri-pālana-jṛmbhamāṇa-mahimā karpūra-pāṃṣ-ūtkaarir=  
devaḥ kirttim=a-yonija[m\*]vitannte yaḥ çaiçave kriḍi-  
tam || Tad <sup>2</sup>=anu MADANA-
- (1. 26,) DRVĪ-nandanaç=candra-gauraiç=carita-bhuvann-garvbha-  
(rbbha)ḥ prāṃṣubhiḥ kirtti-pūraiḥ | kṣitim=avarama-  
tātas=tasya sapt-āvḍhi (bdhi)-dāmnim=abhṛta MADANAPĀ-
- (1. 27,) LO Rāmāpāl-ātmanmā | (u) Sa khalu Bhāgirathi-patha-  
pravarttamāna-nānāvidha-nauvāṭaka-sampādita-setu-  
va(ba)ndha-nihita-çaila-
- (1. 28,) çikhar[i\*]ṇi-vibhramān=niratiçaya-ghanāghana-kavi-ghaṭā-  
çyāmāyamāna-vāsara-lakṣmi-samāravdha (bdha)-santata-  
jalada-samaya-sandehā-
- (1. 29,) d=ḍi(ḍi)cin-āneka-narapati-prābhṛtikṛt-āprameya-haya-  
vāhini-khara-khur-otkhāta-dhūli-dhūṣa(sa)rita-dig-anta-  
rālāt parameçvara-sevā-
- (1. 30,) samāgat-āçeṣa-Jamvu(mbu)dvipa-bhūpāl-ānanta-pāda-  
bhara-namad-avaneḥ çri-RĀMĀVATI-nagara-parisara-sa-  
māvāsita-çrimaj-jaya-skandhāvā-
- (1. 31,) rāt | Parama-saugato Mahārājādhirājaḥ<sup>3</sup> çri-RĀMAPĀLADEVA-  
pād-ānudhyātaḥ Parameçvaraḥ Paramabhāṭṭārako Mahā-  
rājādhirā-
- (1. 32,) jaḥ çriman-MADANAPĀLADEVAḤ kuçali || çri-PAUNDR-  
VARDHANA-bhuktau KOṬIVARṢA-viṣaye HALĀVARTTA-  
maṇḍale [Kāṣṭhagiri-samvimçatyāvādhikopetasa-
- (1. 33,) kaivadārvvacaṭṭaraṭṭake]<sup>4</sup> tṛ[m\*]çatikāyāni bhūmau sa-  
mupāgat-āçeṣa-rāja-puruṣān rāja-rājā(ja)nyaka-rāja-  
putra-rājāmatya-mahāsāndhivi-
- (1. 34,) grahika-mahākṣapaṭalika-mahāsāmanta-mahāsepā(nā)pati-  
mahāpratihāra-ḍauḥsādhasādhanika-mahākumārāmātya-  
rājasthāni-
- (1. 35,) yoparika-cauroddharanika-dāṇḍika-dāṇḍapāsi(çi)ka-çauui-  
ka-kṣetrapa-prāntapāla-kōṭṭapāla-aṅgarakṣa-tad-āyukta-  
viniyuktaka-

<sup>1</sup> Metre Çārdūlavikriḍita.

<sup>2</sup> Metre Mālini.

<sup>3</sup> Read *Mahārājādhirāja-çri-Rāmāpāladeva.*

<sup>4</sup> The reading of this passage remains very doubtful.

## Reverse :

- (1. 36,) hasty-asv(çv)-oṣṭra-nau-va(ba)la-vyāpṛtaka-kiçora-vaḍavā-go-mahiṣ-āj-āvika-ādhyakṣa-dūta-preṣanika-gamāgamika-ati(bhi)tvaramāṇa-vi-
- (1. 37,) śayapati-grāmapati-tarika-çaulkika-gaulmika-Gauḍa-Mālava-Coḍa-Khaṣa-Hūṇa-kulika-Karṇnāṭa-Lāta-cāṭa-bhaṭa-sevak-ādi-
- (1. 38,) n anyāṃç-c=ākirttitān rāja-pād-opajivina[h\*]prativāsino vrā(brā)hmaṇ-ottarān mahattam-ottama-kuṭumvim(mbi)-purogama-caṇḍāla-paryantān ya-
- (1. 39,) thārha[rñ\*] mānayaṭi vo(bo)dhayati samādisa(ça)ti ca viditam=astu bhavatārñ || yath=opari-likṣi(khi)to=yam grāmah || sva-simā-trṇa-pluti-gocara-paryantah ||
- (1. 40,) sa-talaḥ s-oddeçah s-āmra-madhūkaḥ sa-jala-sthalah sa-gartt-oça(ṣa)raḥ sa-jhāṭa-viṭapaḥ sa-dara-çāpasārah<sup>1</sup> sa-cauroddharaṇikaḥ parihṛta-sarvva-
- (1. 41,) pidaḥ a-cāṭa-bhaṭṭa(ṭa)-prāveçah a-kiñcita-paragrāhyah<sup>2</sup> [samasta\*]-bhāga-bhoga-hiraṇy-ādi-pratyāya-sametah ratna-traya-rāja-sambhoga-varjjitah
- (1. 42,) bhūmi-çhidra-nyāyena ā-candr-ārka-kṣiti-sama-kālām mā-tāpitror=ātmanaç=ca puṇya-yaço-bhivṛddhaye [Kautsa]-sagotrāya Çāṇḍi-
- (1. 43,) Iy-Āçi(si)ta-Devala-pravarāya paṇḍita-çri-Bhūṣaṇa-savra-(bra)hmacāriṇe Sāmaved-āntarggata-Kautthuma-çākh-ādhyāyine Campāhiṭṭiyāya
- (1. 44,) CAMPĀHIṬṬI-vāstavyāya VATSAÇVĀ(SVĀ)MI-prapantrāya PRAJĀ-PATIÇVĀ(SVĀ)MI-pautṛāya ÇAUNAKAÇVĀ(SVĀ)MI-putṛāya paṇḍita-bhaṭṭaputra-çri-VaṭeçvaraçvĀ(SVĀ)-
- (1. 45,) MIÇARMAṆE Paṭṭamahādevi-çri-CITRAMATIKĀYĀ Vedavyāsa-prokta-prapāṭhita-Mahābhārata-samutsarjjita-dakṣiṇā-tvena Bhagava-
- (1. 46,) ntaṃ Buddha-bhaṭṭarakam=uddiçya çāsani-kṛtya pradatto s smābhiiḥ | ato bhavadbhiiḥ sarvvair=ev-ānumantavyam bhāvibhir=api pa(bhū)mipati-
- (1. 47,) bhir=bhūmer=ddāna-phala-gauravāt apaharaṇe mahānara<sup>3</sup>-pāta-bhayāc=ca dānam=idam=anumody-ānumodya pālaniyam prativāsi-
- (1. 48,) hhiç=ca kṣetra-karair=ājñā-çravaṇa-vidheyi-bhūyaḥ(ya) yathā-kālām samucita-bhāga-bhoga-kara-hiraṇy-ādi-pratyāy-opanayaḥ kārya iti ||

<sup>1</sup> Read sa-daç-āparādhah.    <sup>2</sup> Read a-kiñcit-pragrāhyah.    <sup>3</sup> Read mahānara-

- (1. 49,) Samvat 8 candra-gatyā caitrakarma-dine 15 [1\*]Bhavanti  
c=ātra dharmm-ānusa(ça)msinaḥ çlokāḥ || Va(Ba)-  
hubhir<sup>1</sup>=vvasudhā dattā rājabhiḥ
- (1. 50,) Sagar-ādibhiḥ [1\*]yasya yasya yadā bhūmis=tasya tasya  
tadā phalaḥ || Bhūmiḥ yaḥ pratigṛhṇāti yaç=ca bhūmiḥ  
prayacchati | ubhau tau puṇya-
- (1. 51,) karmāṇau niyataḥ svargga-gāminau || Gām=ekām  
svarṇnam=ekaḥ=ca | bhūmer=apy=arddham=angulaḥ [1\*]  
haraḥ narakaḥ<sup>2</sup>=āyāti | yāvad=āhūti(ta)-
- (1. 52,) saṃplavaḥ || Śaṣṭim(ṣṭim)varṣa-sahasrāṇi svargge tiṣṭhati  
bhūmidah [1\*]ākṣeptā c=ānumantā ca tāny=eva narake  
vaset || Sva-dattāḥ pa-
- (1. 53,) ra-dattā vām(dattāḥ vā) yo hareta vasundharām[1\*]sa  
viṣṭhāyām kṛmir=bhūtvā pitṛbhiḥ saha pacyate ||  
Āsphoṭayanti pitaro valgayanti pitāma-
- (1. 54,) hāḥ | bhūmido smada(t)-kule jātaḥ sa nas=trātā bhavisyā-  
(ṣya)ti || Sarvvān<sup>3</sup>=etān bhāvinaḥ pārthivendrān bhūyo  
bhūya[h\*] prārthayaty=e-
- (1. 55,) sa(ṣa) Rāmaḥ [1\*]sāmānyo=yam dharmma-setur=narāṇām  
kāle kāle pālaniyaḥ krameṇa || Iti<sup>4</sup> kamala-dal-āmvu-  
(mbu)-vindu-lolām Çriyam=a-
- (1. 56,) nucintya manusya(ṣya)-jīvitam ca[1\*]sakalam=idam=  
udāhṛtaḥ=ca vu(bu)ddhvā na hi puruṣaiḥ para-kirttayo  
vilopyāḥ || Kṛtaḥ<sup>5</sup> sakala-
- (1. 57,) nitijño dhairya-sthairya-mahodadhiḥ[1\*]Sāndhivigrahikaḥ  
çṛimān BHĪMADEVO tra dūtakaḥ || Rājye Madanapālasya  
aṣtame
- (1. 58,) parivaccha(tsa)re | tāmrapaṭṭam=imaḥ çilpi TATHĀGATASARO ç  
khanat ||

<sup>1</sup> Metre Anuṣṭubh ; and of the next five verses.

<sup>2</sup> Read *haraḥ* = *narakaḥ*.

<sup>3</sup> Metre Çālinī.

<sup>4</sup> Metre Puṣpitāgrā.

<sup>5</sup> Metre Anuṣṭubh ; and of the next verse.

*On the identification of Kusinara, Vaisali and other places mentioned by the Chinese pilgrims.—By W. HOEY, ESQ., LITT.D., I.C.S.*

*(With an edition of a new copper-plate Inscription of Jayādityadeva II.—By DR. T. BLOCH.)*

[Read, May 1899.]

The hitherto accepted identification of some places noticed by Fa Hian and Hwen Thsang must be subjected to a very careful re-examination because the discovery of the Lumbini Garden has shown that Kapilavastu lies in a direction quite different from that indicated by General Cunningham and his assistants of the Archaeological Department, and I think it is incumbent on any one who has doubts and can propose points for discussion which may assist in determining the geographical position of ancient places of interest, to lay his views before this Society. It is purely because I am anxious to reach the truth that I venture upon this communication. My main object at present is to show that Cherand and not Besarh is Vaisali and that Kusinara is Sewan itself or near it, but it is as well to use this opportunity to furnish notes regarding other places.

There is no doubt that the city referred to by Fa Hian as Ki-jou-i and by Hwen Thsang as Kie-jo-kio-she-kwo is Kanauj,<sup>1</sup> and I shall take this as my starting point. Proceeding from this the later pilgrim visited, or seems to have visited, Na-po-ti-po-ku-lo, which has been correctly identified with Newal, an ancient site a little north of Bangarman in the Unao District. I visited this place in 1876-77 and obtained Kuṣāṇa coins and independently arrived at this identification. Fa Hian on leaving Kanauj went in the same direction which Hwen Thsang subsequently took and he reached a forest which he called

<sup>1</sup> In view of the frequent appearance of the name 'Lorik' in connection with Buddhist places and the possible connection of a part of that hero's legendary history with Buddha, I here note that it is remarkable to find his father's name given as Buṛhakkubha, 'the old hunchback.' Has this any connection with 'Kanyākubja'? The Ahirs who sing of Lorik are—Kananjī Gwēlās. Lorik is clearly the younger (lahura) brother of Sauru, 'the dark one' (Sānvala).



A-li (*var.* Ho-lo, A-lo) and here he found traces of Buddha in the usual form of memorial buildings. He and Hwen Thsang probably visited the same place. Anyhow I have no doubt that Asi-vana is the forest of A-li, and the present pargana of Asiwan probably represents approximately the area of the forest of Fa Hian's time. The people have a local tradition that the town of Asiwan was founded by one Asan, a name which will be seen to be of importance when I recur later on to the route subsequently taken by Hwen Thsang.

On leaving the A-li Forest Fa Hian proceeded to the country of the Sha-chi. He travelled direct, but Hwen Thsang on leaving Newal went to other places before he reached Pi-so-kia, which is, I think, plainly the capital of the Sha-chi. One is tempted to say that the Sha-chi must be the Sāketas (Sansk.), the inhabitants of Sāketa or Ayodhyā, and to restore Pi-so-kia as Vi-sāka (not Viçākha) so as to introduce a common root to connect Sa-chi and Pi-so-kia as Chinese renderings of Sanscrit names. The temptation is all the stronger because at the S.E. of Ramkot, the ancient citadel of Ayodhyā, we have the mani parbat<sup>1</sup> (Orajhār), which might be thought to be a stūpa, and beside it there are numerous 'chilbil' (Sansk. *civillika*) trees. The twigs of the chilbil are largely used to serve the purpose of tooth brushes. All this bears a plausible resemblance to what both pilgrims record as to the place which they visited but doubt still remains. I have been unable to find any trace of Deva-çarman at Ayodhyā, but I do find that the hermitage of this sage is still pointed out near the Varaha sangam, the junction of the Sarju and Gogra rivers near Pasha, in the Gonda District, where there is still a shrine to which Hindu pilgrims resort. They attach sanctity to this locality because of the image of the Boar here placed which is said to mark the scene of the Varāha Avatāra. I believe that Pasha will be found to be Pi-so-kia, the capital of the kingdom or country of the Sha-chi.

Proceeding from this both pilgrims went on to Çrāvastī, which may be held to be Set-mahet until something tangible be shown to upset the identification. It is true that Kapilavastu is said to have lain S.E. from Çrāvastī or rather the pilgrims went S.E. from that city to visit places on their way to Kapilavastu, whereas the direction of the *supposed* site of Kaṇakamuni's stupa is slightly N. of E. from Set-mahet, but we find so many instances in which directions given by the pilgrims do not tally with directions shown on modern maps, prepared on the basis of careful surveys with modern instruments that we must not argue too strenuously on the directions loosely recorded and often

<sup>1</sup> This spot, however, may really preserve the name of Maṇi-cūḍa, one of the prehistoric kings of Ayodhyā.

palpably misstated by the Chinese pilgrims, who travelled over a country where impenetrable forest and dense jungle rendered an accurate estimate of direction impossible, and where even the distances stated cannot accurately correspond to those taken out by straight lines run across the maps of to-day. Routes were devious 1,250 years ago. A Chinese pilgrim may have left a city A by the S.E. gate and travelled for a time S.E. and then have turned in the tortuous mazes of a jungle northward and traversed what he called 12 *yojanas* before reaching another city B. He would have recorded: 'Proceeding from this place A to the S.E., after travelling 12 *yojanas*, we reach B.' To-day it may be that there is a direct road and we should say, 'Leaving A and going E. along a metalled road for 60 miles we reach B.' I note this here simply to show that we have need to be very cautious in treating the directions and distances stated by the Chinese pilgrims as fixed data in themselves sufficient to enable us to determine locations. The descriptions of places and the names and objects which are said to have existed in their days are much safer data for identification.

From *Çrāvastī* the pilgrims proceeded to *Kapilavastu*. Of this centre of intense interest I need now say nothing. Government has undertaken inquiries and I trust that the present examination of sites north of *Basti* will lead to satisfactory identifications. Meanwhile I have only to say that I recently obtained a copper-plate inscription which will enable the Society to test the accuracy or probable correctness of the results reported. An edition of this plate will be found in an Appendix to this paper. It will suffice here to note the recorded facts. The document is a deed of gift by King *Jayāditya* of certain land to a *Kāyastha* named *Keçava*. The area of the grant seems to have been considerable. It consisted of the town land *Kumāraṣaṇḍikā* including the hamlets of *Patraṣaṇḍa*, *Çaṅkuṣaṇḍā*, *Gāddhī*, and *Deulī*, situated in the *Leḍḍikā* subdivision of the *Daddaraṇḍikā* district. The boundaries are given: on the east the *Rohiṇinadi*; on the south the *tilaka tree* (? forest); on the north the *kumbhī tree* (? forest) and on the west the *Ḥastilaṇḍākhyā khāta* i.e., the Ditch or moat known as that where the elephant was thrown. The date of this inscription is *Samvat 921*, or 864-5 A.D. Thus we have the name of the moat where Buddha cast away the elephant still preserved about two centuries and a quarter after *Hwen Thsang's* visit. The great captain, as he is described in the text, who brought the orders for the gift was *Grahakuṇḍa*, a name perhaps of importance with reference to the *Grah Kuṇḍ* near *Tirbeni*. There is no other proper name which at present strikes me as relevant.

We do not hear of a ditch where an elephant was thrown anywhere save in connection with *Kapilavastu*, but unfortunately I cannot yet

trace the villages or territorial divisions named in the plate, but inasmuch as they contained mines of salt and iron the tract referred to must be near the hills. Is it not possible that Saina Maina (Çāyana Māyana: the dream couch), 5 miles S.W. of Butwal may be Kapilavastu? I think it may be near it at any rate, unless there were more than one sculptured or painted representations of the dream of Māyā which gave to places their names.

I omit for the present the places between the Lumbini Garden and Vaisali but shall return again to discuss them also.

I have long entertained grave doubts as to the identity of Besarh and Vaisali. When Buddha left his home he visited Vaisali and he also consulted the teachers mentioned as Arāḍa Kalāma and Uruvilva Kāçyapa before he reached Gaya. The Kāçyapa here alluded to seems to have resided at the place known as Urwal on the East bank of the Son river, and as Uruvilva Kāçyapa is Kāçyapa of Uruvilva we may conceive Arāḍa Kalāma to be Kalāma of Arāḍa and Arāḍa to be the modern Arrah. In that case, any one will see that Buddha would have been guilty of making a foolish out-of-the-way detour if he went across the Great Gandak to Besarh before going to Arrah, Urwal and Gaya. If, when he fled from his home, he went down country *viâ* Kasia and the Saran district, crossed the Ganges and proceeded to Arrah, then crossed the Son and took Urwal on his way to Gaya, we have a probable route and there is no ground for supposing that he did not take as direct a course as reasonable. These considerations led me to believe that Vaisali must be found in the Saran district, west of the Great Gandak and north of the Ganges.

When Rāma was proceeding from Ayodhyā to Mithilā with Viçvāmītra, he passed through certain places until they reached the banks of the Son, but this river they did not cross. They crossed the Ganges and when they had landed on the other side they beheld the city named Viçāla, where they were entertained by the king Sumati. Viçvāmītra narrated the legendary history of the kingdom over which this king reigned. I need not quote it here, but I refer the curious to the XLV and following sections of the Bālakāṇḍa of Vālmiki's Rāmāyaṇa. There is much that is suggestive in connection with the stories told by Hwen Thsang and I think that the reference by Vālmiki to Çakra justifies the suggestion that Saran may possibly be Çakra + aranya the forest of Çakra or Indra.

We know that when Buddha left Magadha for the last time he went towards Vaisali. The gate by which he left Pataliputra was afterwards called the Gotama gate and the place where he crossed the Ganges was called thereafter the Gotama Ferry. The Gotama Ghat is

still known east of Revilganj. We also have the story of Ānanda's leaving Pataliputra for Vaisali and we read that when he reached the Ganges he discovered that the people of Vaisali had come out to meet him in the hope of obtaining his body as they knew he was about to die and they wished to do it honour: but he was pursued by Ajātaśatru's army which had been sent with the same object. He therefore surrendered himself to death (entered samādhi) on an island in the river and his body parted in two so that the rival claimants obtained equal parts. This story is preserved for us in the name Cherand, which is simply Chidra + anga: the divided body.

It is very remarkable that there is a local tradition at Cherand based on this story. It is this. There was a king at Cherand named Moraddhuj (Mayūradhvaja) in the Dwāpara Yuga who professed great devotion to the gods. Krishna determined to put the king's faith to a test and came one day to his palace disguised as a mendicant and asked for the right half of the king's body for some sacrificial purpose. He explained to the king that his wife and son must each hold one end of a saw (ārā) and saw him in two, but if he shed tears the gift would not be acceptable. The king agreed and the operation commenced but presently he began to shed tears from his left eye. The mendicant reminded the king that the professed gift was liable to rejection but the latter explained that the left eye wept because the right half of the body was alone being taken and the other left. Krishna was so pleased with this devotion that he exercised his divine power, stopped the operation, restored the body to its former state and flung the saw away. It fell at Arrah in the Shahabad district, giving its name to that place. This story is certainly the same in origin as that told of Ānanda. It is a Hindu version of facts underlying the Buddhist story.

The conclusion to which I come is that Vaisali did not lie on the east but on the west of the present Great Gandak. I shall presently fix it beyond doubt east of Chupra probably at Cherand itself. The whole of the northern bank of the Ganges from Hajipur right up to Manjhi (Mangchi in the Ain-i-Akbari) would repay careful and minute examination.

I may here digress for a moment to make some notes as to Saran Khass which I at first erroneously surmised to be Vaisali and visited for that reason. Saran Khass lies about 16 miles due north of Manjhi, and contains extensive ancient remains covered for the most part by cultivated fields. There is an abrupt rise at Makhdum Shah's Dargah, a little south of Harpur, which continues for a couple of miles south until it terminates somewhat more abruptly beyond Khwajah Pir's

Mazar. On the east of this elevated site runs a stream known locally by two names, Gandaki and Sarayu. This is well defined and may have been a channel made in ancient days for water supply. West of this and parallel to it the high ground extends for an average width of not less than half a mile. As I passed from the northern end I observed undulations with occasional very prominent heights and noticed that cultivators have taken out numerous bricks while ploughing. On approaching the southern end I observed a pile near a mound on which are the remains of a brick building. I learned that this pile is the Ganj-i-Shahidān or Martyr's Heap near the traditional Raja's kot. This indicates a desperate assault at some time on a Hindu stronghold. Further on I came to Khwajah Pir's Mazar and found two tombs in an open enclosure. In one corner there was a large black stone about  $4\frac{1}{2}$  ft. long on which I observed Hindu sculptures of the *Navagraha* or nine planets. On the back of the slab there was a long inscription in Tughra character of which I had not then the means of taking a rubbing. It is much worn and could not be read at sight. It is probably historically important.

A few miles west by north of Saran khass is a village called Bhikaband on the map. I visited this spot, also and find that there is here a large banian tree which is said to cover about ten acres. In the ground near there are brick remains and an old well lately reopened. Somewhat S. E. of this is an old temple and the attendant Brahmins wrote the name for me: *Bhikaban*, which is clearly the 'Bhikshu's Grove.' About a mile west of this are two villages bearing the name Kapia, which suggests the story of the service rendered to Buddha by the monkey (*kapi*) as mentioned by the later Chinese traveller.

I shall now proceed to resume my discussion as regards Vaisali itself. There are some suggestions based on a study of the *Mahā-parinibbāna Sutta* which I must note. When Buddha had crossed the Ganges for the last time on his way to Vaisali he first visited Koṭigāma and then Nāḍika, after which he arrived at the great city. There he was entertained by the courtesan, Ambapali, at her mango grove outside the city. From Vaisali Buddha went on to Veluva where he was seized with the illness which eventually terminated his life. This is probably the modern Belwa, N.E. of Cherand. Near it we meet with such remarkable names as Sārṇāth Chak and Dharma Chak. Buddha then seems to have turned again towards Vaisali for he went to the Cāpāla Caitya, which the text would lead us to believe to have been near the city, if not in it. This name is probably either from *Uapalā* or *cāpalā* (Sansc.), a loose woman, and thus alludes to the concubine

spoken of by the pilgrims; or from *cāpa + ālaya* (Sansk.), the 'bow-place,' where the bow was deposited. Anyhow there can be no mistake as to the mound lying to the east of the town of Chupra, called Telpa. This is undoubtedly the Sanscrit *talpa* 'a tower,' and is that built for the mother of the thousand sons and the site of Vaisali is therefore fixed. It is the modern Cherand and was spread along the bank of the Ganges east and west of the present town.

The five rivers to the junction of which the Chinese Pilgrim Fa Hian proceeded was the mouth of the Son. The five rivers are the Jumna, Ganges, Rapti, Sarayu or Gogra, and the Son. Fa Hian crossed at Paleza-Digha Ghat, and had only to go one yojana to reach Pataliputra (Patna). The distance from Cherand to Paleza Ghat is  $18\frac{1}{2}$  miles. This was four yojanas and gives a trifle over  $4\frac{1}{2}$  miles to the yojana. According to Hwen Thsang the yojana consisted of 4000 bow lengths, each 6 cubits, This means 8000 yards which give us 4.54 miles to the yojana.

We learn from Rockhill's Life of the Buddha based on Tibetan authorities that Buddha on finally leaving Vaisali visited a place called Amra, which may be Amnaur (Amranagara), Jambugāma, Bhaṇḍagāma, Hastigāma, which may be the present Hathwa, and Bhoganagara. After this he reached Pāva.

I now come to speak of a place of which I have some personal knowledge. There is a village known as Papaur or Pappaur (Pāva + pura or Pāpa + pura) about three miles east of Sewan. I visited it some years ago. Near the present homestead there are the remains of a more ancient habitation from which I obtained some copper Indo-Bactrian coins. It represents a place of great antiquity and must be the Pāva where the goldsmith Cunda lived. When Buddha came thus far he went with his followers to the goldsmith's grove and while there he accepted an invitation to dine with the goldsmith to whose house he went. There he was served with the *sūkara*<sup>1</sup> which aggravated the symptoms developed at Veluva and gave his illness a fatal turn. This led him to resolve to push on to Kusinara and he set out with Ānanda in that direction. He was then at least 80 years old and suffering from dysentery. He could not have travelled far and we observe that the Mahāpariṇibbāna Sutta represents him as halting under a tree at least once and reaching a river with difficulty. The salient points in connection with his last brief journey are that he left Pāva, halted under a tree, moved on again to a stream called Kakuttha and having crossed

<sup>1</sup> This is not boar's flesh, but *Sūkara-kanda* 'hog's root,' a bulbous root found chiefly in mounds and jungles, which I have seen Hindus eat with avidity. It is a *phalahar*, permissible to eat on fast days.

a river bearing a name suggestive of gold, he reached the people's park near Kusinara and lay down under some sal trees. Possibly he had not come to Kusinara because he sent Ananda to bring the Mallas to him. After his death there was an imposing ceremony to do honour to his remains. He was laid out on a golden bier and is said to have been kept for seven days: and it is said that he showed his feet from out his winding sheet and he even raised himself and spoke. There was difficulty in moving his remains until Kāçyapa came. Thus the spot where his bier rested was one that must have borne a name associated with it. That name is Sewan, the Sanscrit *çavayāna*: a litter or bier. There is something in names. It is remarkable that we have a particular tree of great age at a mound near Sewan Railway Station. This is known as Jagattra, the Protector or Deliverer of the world. One would expect Hindus to venerate this spot but they do not. They consider it ill-omened. The late Raja of Hathwa desired to enclose all this spot, but the Pandits told him that the act would bring him bad luck. He enclosed a large patch but left the tree outside the walls. He died soon after. This Jagattra is looked upon as the oldest place about Sewan, and its name and associations are significant. There is also a very high mound not far off which has not been explored. I can have no doubt that Kusinara lies somewhere close to Sewan if it be not Sewan itself.

The indefatigable Major Waddell has in the third number of the Journal of this Society for 1896, published an abstract of a Tibetan Guide Book to Buddhist sites in India. It is unfortunately a brief and vague *vade mecum* for the traveller and is absolutely unreliable in some of the directions which it gives, but it tells us that the Bāla grove where Buddha died is in the N.W. of the Kamalla or Bāliya des, 'the powerful country.' I find that the tract of country eastward from the Dāha river near Sewan and stretching north of the Manjhi and Cherand tappas or parganas is called Ball. Sewan is in the N.W. of the Ball country. This is probably the country of the 'powerful' people (*bala*) and is possibly the same as *malla* (powerful, athletic). When Buddha left Vaisali and visited various places before reaching Pāva the places are said to have been villages of the Licchavis and the Mallas.

Hwen Thsang tells us two Jātaka stories in connection with the country of Kusinara. The one is that of the pheasant which tried to extinguish a forest fire by dipping in water, flying aloft, and shaking its wings that the water might fall on the fire: but the bird's efforts were unavailing and at last Çakra (Indra) put out the fire. This is not a misplaced story in Sewan, the Çakra-aranya. The second story is that of the deer which, when the forest was burning, helped animals across the river and last of all saved a helpless hare, and itself perished. Now,

both stories mention a conflagration and a river. There is one word in Sanscrit which expresses both conflagration and cremation. It is 'daha.' The river so named is the river of 'conflagration' and also the Çava-daha, the cremation river of the Malla or Balla people.

The Daha takes its rise N.E. of Gopalganj and in its course forms the sheet of water known as Sasa Mansa (*Çaça-mokṣita* 'the rescued hare') and then flows southward to Andur. Near this (at Faridpur) it is joined by the Sondi River and thence its course is S.E. until it falls into the Gogra east of Manjhi. The Sondi is said to be an offshoot of another stream called Narayani but I cannot find this on the maps. It comes down past Manjha Mntkar and Manjha Mallaon. I have said that we must find the word for gold entering into the composition of a river near Kusinara. It is given in the Chinese as Hi-lian and Shilai-na-fa-ti. The latter is obviously Suvarnavati, which, anyone accustomed to note mutations from Sanscrit to Hindi will see, becomes Soṇa-vati, or Soṇa-nadi, or Sondi or Sundi.

I have not been able to visit any places near Sewan except Pappaur, but a gentleman who has taken considerable trouble to help me in my researches tells me that there is a very extensive ancient mound covered with trees, locally called a fort of the Cheroos, between Luhsi and Kulinjura about 3 miles N. W. of Sewan. There are also remains of great age on the west bank of the Daha in Gosopali opposite Salannapur. This name suggests *Sāla-vana-pura*, the city of the Sāla forest. The mention of the Sāla here in any form is interesting. These places should be examined.

There are also considerable remains and a large basalt image further down the Daha at Hasanpur which should be looked to. From this place I received an inscription on a brass plate not yet deciphered.

South-east of Kusinara and west of Vaisali lay the place where Buddha parted from the Licchavis. This is probably Manjhi, the Māngchi of the Āin-i-Akbari. It is the 'Māng' or 'Mānjha', the middle line, the parting, and lies on the west of the Daha or Sundi where it joins the Ganges. The Sundi or Daha river was probably the western boundary of the Vaisali kingdom, a narrow tract lying along the bank of the Ganges.

I now return to the Lumbini Garden and ask what were the points visited by the Chinese pilgrims between that place and Kusinara. It is not yet settled what the Rāmagāma Kingdom was or where the town called after Rāma lay. I may mention that the very old town of Kanapar near Dham is also called Ramnagar, but that is not necessarily significant. I can, however, with knowledge point to a very ancient mound called Ghagharra between Pipraich and Captainganj, which



should be examined as a possible Stūpa cum Vihāra site. After the Rāmagāma stūpa, the pilgrims visited the place where Buddha performed the three great acts of renunciation, where (1) he sent back his horse, (2) he took off his crest-jewel and cut his hair, and (3) he put on the *kaṣāya* robe of the ascetic. We know from the Lalita Vistara and the Romantic Legend that the memorial stūpas erected to mark the place where these three acts were performed were close together. We also know that on his flight from home the Prince came to the country of the Mainas. Kasia lies on the Mainpur tappa, and I believe that the Prince crossed the Chota Gandak in the morning after he left home, and that a black stone image still lying under a tree opposite Hetimpur is a remnant of some memorial there placed to mark the spot where he crossed. The Prince then entered the country of the Mainas, as I have shown above, and the remains at Māta Kunwar, at Ramabhar, and inside the cane-brake in Kasia town, are what we have left of the memorial buildings placed to commemorate the Great Renunciation. Kasia is the place where the Prince received the *kaṣāya* garment or robe of the mendicant.

The Charcoal stūpa has yet to be found but I am in hopes that it will be identifiable in the mound of Agarwa, N. E. of Taria Sujan which I have not yet seen. The name itself being obviously derivable from *aggarika*, charcoal or embers, is promising.

Having located Vaisali at Cherand, I may ask: 'What then is Besarh?' Fortunately that is easily explained. When Hwen Thsang speaks of the country Fo-li-shi, north east of Vaisali, he means Pa-lā-sa or Parāsa,<sup>1</sup> the country of the dāk tree, a name which was given to at least the trans-Ganges part of Magadha. He tells us an exaggerated story about a monster fish in this country and a stūpa commemorating the conversion of 500 fishermen by Buddha. Besarh is the Sanskrit word *vasāḍhya*, the Gangetic porpoise, and the remains at Besarh are those of the town or city of the Monster Fish.

The mere fact that an Asoka pillar may be found somewhere near Besarh does not make it Vaisali: nor are we entitled to say that Cherand is not Vaisali, because an Asoka pillar has not yet come to sight there. It would be interesting to know why Asoka placed his pillars in many places which he selected. I would suggest that he selected Kesaria and Araraj as pillar sites because they probably represent the places where Buddha was believed to have been in former lives respectively a *Kesari* or lion and the *Arindama Rājā*.

Let me now return to Kanauj and take up Hwen Thsang's route. I assume that he visited Newal and we have to look for 'O-yu-t'o and

<sup>1</sup> The country of the *πασσιαι* mentioned by Megasthenes.

'O-ye-mu-khi. The first thing to observe is that the Life of Hwen Thsang shows that he travelled by boat on the Ganges. He must have used a boat to cross from Kanauj on his way to Newal. He was certainly on a boat when attacked by the river-dacoits while on his way from 'O-yu-t'o to 'O-ye-mu-khi. No place that he mentions between Newal and Prayāga can have been very far from the Ganges. The Life differs from the Travels in important details. If we read the latter alone it would seem that Hwen Thsang speaks as if he was reckoning from Newal to 'O-yu-t'o, while the Life represents as a starting point the Bhadra Vihāra where the pilgrims had stayed for three months at Kanauj. These apparently trivial variations are important, because they affect the position of 'O-yu-t'o with reference to the Ganges. Anyhow the distances are 600 li to 'O-yu-t'o, 300 li to 'O-ye-mu-khi and thence 700 to Allahabad. The direction of the intermediate length is described as East. The general direction of the Ganges between Kanauj and Allahabad is S. E. There is a stretch of the river roughly W. to E. between Baksar Ghat and Dalman. The last named place is the spot where Dālabhya Ṛṣi spent his life and west of it a few miles is Chilanla, a name which recalls the Shi-lo-ta-lo of the pilgrim. This is the traditional abode of the Ṛṣi Cyavana, restored to youth by the Aṣvins. A little farther west is Gagason, venerated by Hindus as the *ācrama* of Garga, a muni who left a host of descendants; and close to this again is Sinhaur, another place of great antiquity. Taking the Singhar Tāra crossing near Sinhaur crossing and crossing south of the river we reach Tāra Bhitaura or Bhati-ura, supposed to be a dwelling place of descendants of Bhṛṅu, and proceeding a few miles east we reach Asni, opposite Gagason. At Asni is the shrine<sup>1</sup> of the Aṣvins, the twin sons of Sūrya (the sun) who are represented by two brass images with their hair coiled over their heads. The myth runs that these deities were born from the nostrils of a mare. May not 'O-ye-mu-khi be *Aṣvā-mukha*, 'the mare's Head,' and this cluster of sacred places be the kingdom referred to by the pilgrim. The story of the Rishi at Chilanla restored to youth by the Aṣvins may be another form of the narrative of the conversion of Buddha Simha and of the three pious Buddhists who made the bargain about reappearing after death. Anyhow these places are connected and mark what may have been regarded by Hwen Thsang as a kingdom with its capital on the northern bank of the Ganges, that on which the majority of the shrines lies.

<sup>1</sup> A modern shrine built by the late Maharajah of Benares, but the place was known as Asni long before. It may be that Āsanga and his brother were remembered here as "The pair of brothers."

I have when writing about Asiwan referred to the significance of the name Asan as the founder of that place. Might not this name be the Asanga of the Chinese Traveller? We meet with a similar eponym in connection with Asoha, the chief town of Asoha pargana in Unao district, where the people call the founder Asa Rikh. There are some remains at this place where Bactrian Coins have been found: and these remains may be Buddhist, but it would be rash to say as yet that Asoha is 'O-yu-t'o.

I need not say anything as regards Prayāga which can be no other spot than Allahabad. From this undoubtedly fixed point Hwen Thsang went to Kosambi which has been identified with Kosam *cum* Pabhosa on the northern bank of the Jumna. My learned friend Mr. Vincent Smith, has lately written disputing the correctness of this identification and I must admit that my faith was at first shaken by his arguments. I have a great respect for his acumen but I venture to say that, after considering all that he has written, I cannot but hold to the original identification. Mr. Smith has not himself visited Kosam.

As Hwen Thsang travelled by boat on the Ganges it is highly probable he moved by boat along the Jumna. In that case his first direction would have been S.W. and on his left at any rate we would have had forest as one can see who has traversed the Barah Tahsil of Allahabad District and the adjoining parts of Bandah District. The journey by river would be long and tedious enough to account for the great distance recorded, 500 li. When the traveller left Kōsambī and went north he passed through a dense forest. This may possibly be the present Atharban pargana. As we have the *Antar-ved* for the Ganges-Jumna Doab, the name may really be correctly *Antar-vana*. This point is worth examination. At any rate *vana* (forest) is beyond doubt.

In Rockhill's "Life of the Buddha" (page 74), where the account of the conversion of the king of Kosambi<sup>1</sup> is given, we are told that at that time the king of Vatsala had assembled his army with the intention of conquering the city of Kanakavati. West of Kosam about 16 miles on the southern bank of the Jumna where it is joined by that Paisuni river, there are extensive ruins known as Kankotah or Kanak Kot. I have seen them. I excavated a part some years ago and found inscribed stone lintels. This is, I believe, the Kanakavati referred to, and the position of the two capitals recalls the similar location of Pataliputra and Vaisali.

<sup>1</sup> I see no reason to suppose that the Vatsa country is not the Kingdom of Kosambi.

There has not been much reliable result obtained yet by attempts to identify the places between Benares and Pataliputra. We have to find the kingdom of Chen-Chu, 'lord of battles.' General Cunningham's endeavour to make Ghazipur the equivalent of Chen-Chu is strained and unfortunately, I fear, does not rest on any solid fact. The form locally given of the ancient name is not, I understand, Garjapur but Gadhipur. The General might as well have said that 'Ghāzi' is equivalent to 'lord of battles.' The name of the kingdom or, may it not be, of its ruler, is *translated* into Chinese as Chen-Chu. Its capital was on the banks of the Ganges. This is, unfortunately, not a certain key to the place in modern times. A careful examination of local traditions in connection with existing ruins and names may lead to identifications.

I may illustrate the value of tradition by quoting a very curious history handed down of a kingdom which may be that referred to by the Traveller. There was a king somewhere who had a daughter called Kanchavi for whom he could not get a husband. His pandits told him that it was written in her destiny that she should marry a man of low caste. He asked who this might be and they said he was a certain servant in the king's retinue who was a Piṣvān. A Piṣvān is explained in the story as being a Cheru and the Cherus are said to be represented now by the Dusadhs. The king resolved to send this servant to the end of the earth. He therefore wrote a letter and calling him up told him that Rāmacandra had been born and that he must take this letter, an invitation to Kanchavi's wedding and find Rāmacandra and hand him the letter. He warned him further that, if he returned without delivering the letter, he would be sawn in two. The servant set out and endured great privations and hardships, wandering here and there from place to place, until he met a venerable man in a jungle, who was in reality Rāmacandra and who asked him who he was and where he was going. The king's messenger then told him all about his mission and the letter which he carried. Rāmacandra informed him that he was a *cela* or follower of the person sought and he would accept the letter for him. The messenger delivered the invitation which Rāmacandra read and said: 'Go back, I have accepted the invitation. It is you who will marry the girl.' The Piṣvān now turned homeward and as he was passing through the Waina forest he heard a voice calling out: 'Who are you?' but he could see no one. He heard the question repeated again and again and at length replied: "Who are you that I hear calling while I see no one?" The answer came: "I am a tree that bears no fruit and I am sad because other trees have fruit while I

yield none. If you know any remedy for this, tell me." The messenger though a Dusadh had been a king in a former birth but because of his misconduct he had been reborn as a Dusadh, and all his wealth and greatness and evil deeds lay buried at the root of this tree, and prevented the tree fulfilling its purpose as a fruit-bearer. Now, by his interview with Rāmacandra, he had obtained illumination and was enabled to see his former life, and he at once knew that it was under this tree that his wealth lay buried: so he told the tree to lean over that he might take out what lay at its root. This the tree did and the man took out his former wealth and recovered his greatness. He became a Raja once more, employed a number of men and built a palace on the spot. He enlisted an army and marched to marry the princess Kanchavi. He encamped in her father's country. The king thinking of his daughter's unmarried state came out and asked him to marry her but, not desiring to seem anxious, he refused, saying that he did not intend to marry for he preferred to spend his days in visiting places of pilgrimage. When the king pressed him he married Kanchavi, who subsequently recognised him by certain marks which he bore. When he returned to his country he built four forts and his descendants were kings for four hundred years. The four forts lie in the Ballia District: the first Waina is in the Wainaban where he had found his wealth under the tree; the second is Kopachit; the third is Sikandarpur;<sup>1</sup> and the fourth was where Hūsenabad now is in the Banodih Tahsil.

At first sight this seems a very silly tale but the key to its value lies in the word 'Piçvān,' which is from the Sanscrit Piç 'yellow.' There is no caste or race in India called Piçvān but the word refers obviously to a yellow Race. This is the Mongolian or Chinese people. Hwen Thsang tells us of the men from Tu-ko-lo beyond the snowy mountains (obviously yellow people) who came and wandered in India friendless and inhospitably treated, till they met a king who built for them the monastery of the 'unpierced ears.' It was an ornamented building of small dimensions near a lake. The modern Waina in Ballia has ancient remains and it lies to the south of the broad expanse of water known as the Suraha Tal. A few miles S. E. is Ballia itself, the Bhṛgvāgrāma, the Kapileçvara and the Dharmāranya; and until the last floods washed it away here too on the Ganges bank, I am told, was a temple of the Sun-God, Sūrya-Nārāyaṇa. The general conclusion is that the monastery of the unpierced ears will be found at

<sup>1</sup> There are extensive ruins at Sikandarpur and close by we meet with Rāhila-pāli, which reminds us of Rāhula and the old Brahman. This place with reference to Sewan as Kusinara fits in with the place visited by Hwen Thsang on his way to Benares.

Waina<sup>1</sup> or in its neighbourhood, and that it was at Ballia that Hwen Thsang crossed the Ganges to go to Mo-ha-so-lo (Masār).

I regret the length of this communication but I have been anxious for sometime past to contribute what I could to the researches now in progress. I have endeavoured to avoid all appearance of dogmatic assertions and remembered that it is extremely unsafe to argue about places which I have not seen or which others have not fully explored. If I can by suggestions, however crude, assist others in research, I am satisfied.

#### APPENDIX.

*An edition of a new copper-plate inscription of Jayādityadeva II.—*  
By DR. T. BLOCH.

This Inscription, which is edited here for the first time, has been referred to in the preceding paper on page 76. Regarding its find-place, etc., Dr. Hoey makes the following remarks :—

“I have found it very difficult to trace out the place where this copper-plate, which the son of the Raja of Bansi made over to me, was originally found. It came into the possession of the Bansi family through Durbali Ram Tewari, a Pandit employed to look after a Sanscrit library which the Bansi Rajas have kept up. A very old man named Gauri Charan Lal of Kubabar tells me that a Brahman of Gurmha brought in this copper-plate two years after the mutiny and asked to have it read. So he sent it on through his brother, then employed at Bansi, to the Pandit. The mode of discovery was this. Some men were employed to dig kunkar at the North-East corner of the large sheet of water covering over 30 acres at the village Gurmha. It is a long strip of water extending within Rakhnakhor and Pachgawan. The kunkar was to be supplied for some purpose by two Dakhani Brahmans, who had taken a contract. The labourers, in the course of excavation, found two pots, one containing silver coins, the other gold coins and this Copper-plate. Of course the coins have long since disappeared. I have not been able to visit this place, but I shall now furnish some notes regarding it, and other places of interest, in the same Tappa *Pachgawan*, which lies North of Gorakhpur City. These notes are reliable, because they have been recorded by an English-speaking, well-educated native Magistrate, who is a graduate, and has, in his enquiries, acted under my instructions and provided me with photographs.

*Gurmha* is not a large village, but the lake is remarkable for a very massive high mound of bricks at the East side, on top of which rises a

<sup>1</sup> Wainaban is clearly the Vinayaka-vana, the forest of discipline (Vinaya), a parallel to the dharmāranya of the Hindus and Buddhists.

huge pipal tree. Some sculptured remains have been found here, and taken to the monastic cell of a goshain who lives North of the lake. *Pachgawan*, which is south-west of the lake, is a very old place, from which people have recovered grindstones of antique pattern. I think there must be something of importance in the word *Gurmha*, because the name *Gurmhi* occurs as that of the small tappa in which *Sohgaura*, and *Tikar*, where I recovered the Indo-Pali Copper-plate, are situated.

*Bharuhia* lies west of *Tighra* near *Pepeganj* railway station. Here there is a very ancient temple which has been restored, or repaired, and in one wall of it there is a stone containing a Sanscrit inscription. The temple is called *Pitesar Nath*. The proper form of the name occurs in the inscription. There was another ancient building in ruins east of *Bharuhia* called *Nakta Dei*, which some Tharus overturned about 60 years ago, when they came in a body and searched for treasure.

There are other places which might repay examination, for instance *Gāngpār* and *Khātapār* near *Bharuhia* and *Tighra*. West of this there is a series of almost continuous village sites: *Rāmghat*, *Pallia*, *Pachwāra*, *Dihwa* and *Ramwapur*, in each of which there are ruins. They seem to be a connected block, as though they were the site of one continuous city.

In order, if possible, to discover what was the *Vijayapura* referred to in the copper-plate, I made enquiries as to old sites in this neighbourhood, and I came to find that there are round about *Gorakhpur* the following remains of ancient fortified posts, which it may be as well to record. (1) *Shergarh* west of the *Rapti* and of *Gorakhpur* much cut away by the river. (2) *Ramgarh* which gives its name to a large lake east of *Gorakhpur* city. (3) *Sumergarh* north of *Bhathat* about 18 miles north of *Gorakhpur*. (4) *Bherigarh* north-east of *Gorakhpur* city. (5) *Baitalgarh* on some high ground near the road leading from *Gorakhpur* to *Pipraich*. (6) *Marwargarh* near the shrine of *Tarkulia Devi* two miles north-east of *Mirzapur* village. (7) *Kuwalgarh* at *Kawaldah* in the immediate north of *Gorakhpur* city. (8) *Domangarh* on the *Rapti*, west of *Gorakhpur* city. (9) *Bijaiagarh* known as *Kotiya*, standing in the big sheet of water west of the now ruined *Mahesra* bridge south of *Maniram* railway station.

There is a tradition of two kingdoms *Bijaipur* and *Udaipur*. A line drawn from *Padrauna* westward to the *Rapti* would about indicate the parting line. North of it lay *Udaipur* and south of it *Bijaipur*. I am not inclined to say that all the nine forts enumerated were simultaneously existent as fortified posts of the *Bijaipur* kingdom. Local traditions show that this could not have been so; but the existence of so many of these ancient strongholds, round about the junction of

the Rohiṇī and Rapti rivers, shows that the position was recognized from the earliest times as one of strategic advantage."

The inscription is engraved on a single copper-plate measuring  $12\frac{3}{4}$ " by  $12\frac{3}{4}$ ". On the top there is an oval projection, upon which we find the representation of full-blown lotus, the centre of which consists of a raised disc bearing the image of some animal, perhaps a boar, with *Ṣri-Jayāditya-devaḥ* written below in raised characters. The writing consists of 24 lines, covering only three quarter of one side of the plate. It is fairly well executed and well preserved; however, the meaning of a few passages remains doubtful. The characters belong to the northern alphabet and are in every respect similar to those of the Gorakhpur plate of the same king, belonging to this society, and edited by Prof. Kielhorn in the *Ind. Ant.* Vol. XXI, 1892, p. 169 ff. Thus, in the conjunct letter *rya* the *r* is written on the line in *pariyanta* (ll. 1 & 12), and *kāryā* (l. 19); and the *anusvāra* is placed after not above the *aksara* to which it belongs in *pravṛttinān* (l. 5), and *bhūbhujān* (l. 19). The language is Sanskrit, and with the exception of four imprecatory and benedictive verses in ll. 17-21, and a verse referring to the grantee, the *Kāyastha Keçava* in ll. 22-24, it is in prose.

The object of the Inscription was to record a grant made by king Jayādityadeva II. (l. 8), who was the son of Dharmādityadeva and his wife Candrādevī (l. 4) and the grandson of Jayādityadeva I. and his wife Yogādevī (ll. 3 & 4), all of whom belonged to the Malayaketu family (l. 3) and received the titles *paramahattāra-ka-mahārājādhirāja-parameçvara*. The document was issued from Vijayapura (l. 1). The grant consisted in the village Kumāraṣaṇḍikā, connected with the *pallikās*: Patraṣaṇḍā, Çaṅkuṣaṇḍā, Gāddhī, and Deulī, which lay in the Leḍḍikā *viçaya* and the Daddaraṇḍikā *maṇḍala* (l. 8). It was given to a *Kāyastha Keçava*, son of a *Kāyastha Dhemuka*, and grandson of a *Kāyastha Rudra*, in recognition of good services rendered by him to the king (l. 13). Its boundaries are laid down in l. 15; they were: in the east the river Rohiṇī; in the south a *tilaka* tree; in the west the ditch called Hastilaṇḍa; in the north a *kumbhī* tree. The document is signed by the minister (*mahāmantri*) Māhaka. The *mahāsāmanta* Grahakuṇḍa acted as *dātaka*. The inscription was written by the *Kāyastha Valadduka*. Its date is given as *Samvat* 921 (ll. 21-22).

The date doubtless must be referred to the Vikrama era. Of the geographical names mentioned in this inscription, the river Rohiṇī is the only one that at present can be identified. As regards Vijayapura, we learn from the Gorakhpur Inscription (*l.c.* p. 170) that it was situated on the slopes of the Himalaya (*uttaragiri-kaṭake*).

I now edit the inscription from the original plate:—



## Transcript.

1. 1, Om Svasti | Çri-VIJAYAPURĀC=catur-udadhi-paryanta-nirantar-ākṛānta-kirtti-sautatinām=ananta-nitānta-phal-ānumeya-āravdha(bdha)-vividha-kṛtyānām jagad-udayāya gr̥hi-
1. 2, ta-dṛḍha-vratānām=ati-samrūḍha-rājarṣi-patha-sampravart-tayitṛṇām samantād-gr̥hita-pūrvva-niti-vyavahārāṇām prajānām=upakarttavayam=ity=evam=ādṛta-matiḥ<sup>1</sup>
1. 3, samastetikāyo<sup>2</sup>MALAYAKETŪNĀM=anvaye || paramabhāṭṭāraka-mahārājādhirāja-parameçvara-çri-JAYĀDITYADEVAS=tat-putras=tat-pād-ānudhyāto mahādevyām rājñi-
1. 4, çri-YOGĀDEVYĀM samutpannaḥ paramabhāṭṭāraka-mahārājādhirāja-parameçvara-çri-DHARMMĀDITYADEVAS=tat-putras=tat-pād-ānudhyāto mahādevyām rājñi-çri-CA-
1. 5, NDRĀDEVYĀM samutpannas=sahajasya vidyā-janitasya ca sam-skārasy=ādhāro dharm-ārtha-kāma-viruddhānām=indriya-pravṛttinām sanniroddhā prāyeṇa vikram-aika-ras-ā-
1. 6, bhiprāya-vāda-bhidyamāna-pracaṇḍ-ārāti-maṇḍalō naya-vinaya-prasādhit-āçeṣa-bhū-maṇḍalaḥ sarvva-daiv-ākhaṇḍita-mati=Ākhaṇḍala-tulya-tejā rājabhīḥ
1. 7, çiro-bhiruhyamān-āpratihata-çāsanaḥ çāsanānām pradātā paramamāheçvaro Maheçvara iva sarvva-satva<sup>3</sup>-kṣema-tat-parah paramabhāṭṭāraka-mahārājā-
1. 8, dhirāja-parameçvara<sup>4</sup>-çri=JAYĀDITYADEVAS kuçali || DADDARAṆPIKĀ-maṇḍale | LEPPIKĀ-viṣay-āntarvartti-KUMĀRAṢAṆḍIKĀ-grāme | Patraṣaṇḍā | Çaṅkuṣaṇḍā | Gāddhi | Deu-
1. 9, li-pallik-ānvite | samupagat-āçeṣa-rājanna(nya)ka-rājaputra-rājasthāniya-purohit-āmātya-mahasāmanta-mahāsāndhivigrahika-mahāpratihāra-mahākṣapaṭalika-mahādaṇḍanāyaka-
1. 10, pañcamāṇḍapādhipati-mauladāṇḍika-dāṇḍapāçika-mahāsā-dhanika-cauroddharāṇika-çaulkika-gaulmikān || anyāṇḍ<sup>5</sup>=c=ākirtitān=ā-cāta-bhata-vra(brā)hmaṇ-ottara-jana-
1. 11, padanç=ca<sup>6</sup> yathārham=mānayati pūjayati vo(bo)dhayati samājñāpayati ca[||\*] Viditam=astu bhavatām=ayam=uparilikhita-grāmas=sa-jala-sthalas=s-āmra-m[adh\*]ūkaḥ sa-gartt-oçaras=sa-
1. 12, loha-lavaṇ-ākaraç=catus-simā-paryantas=sva-pallik-opetaḥ samasta-rājapratyādāya-samaveto bhūmicchidra-nyāyen=

<sup>1</sup> Read *matinām*.<sup>2</sup> Read *sattva*.<sup>3</sup> Read *anyāmç*.<sup>4</sup> I am unable to make out the meaning of this word.<sup>5</sup> Originally written *parameçvaraḥ*.<sup>6</sup> Read *padāmç = ca*.

ā-candr-ārka-kṣiti-sama-kālina[m\*] yāvat=pūrvva-bhuk-  
ta-bhu-

1. 13, jyamāna-deva-vrā(bṛā)hmana-kṣetra-khaṇḍito=smābhri=ati-  
sev-ārādhitau(tai)ç=Caravāsaka-satka-kāyastha-RUDRA-  
pautrāya kāyaspha(stha)-DHĒMUKA-putrāya Singhapad-  
dhateḥ kāyastha-
1. 14, KEÇAVĀYA | çāsanena prasādi-kṛtō matvā bhavadbhri=anu-  
mantavyam nivāsibhiç=c=ājñā-çravaṇa-vidheyi-bhūya  
samucita-bhāga-bhog-ādikam=asya samupanetavyam[\*\*]
1. 15, Tatra ca simāno likhyante | pūrvvasyām diçi sima-nirṇua-  
(rṇṇa)ya-kāriṇi Rohiṇi nāma nadi | dakṣiṇasyān=tu tilaka-  
tarur=avatiṣṭhate | paçcimāyām Ha-
1. 16, stilaṇḍ-ākhyah khātaḥ | tath=ottarasyāni knmbhi-vṛkṣah |  
evañ=catasṛṣv=api dikṣu vibhakta-simakam grāmam=pra-  
sādi-kṛtya tat=kṣaṇam=eva nṛpati-
1. 17, r=idam=avādit | Va(Ba)hubhir<sup>1</sup>=vvasudhā dattā rājabhis=  
Sagar-ādibhiḥ | yasya yasya ya tā bhūmis= tasya tasya tadā  
phalaḥ | (¶) Sva-dattām para-dattām=vā yo hareta
1. 18, vasundharām | sa viṣṭhāyām kṛmir=bhūtvā pitṛbhis=saha  
pacyate ¶ Dattāyāḥ<sup>2</sup> paripālanam bhavati yad=deva-dvije-  
bhyo bhuva[s\*]=tyāgns=tatra na ko=pi pranga-
1. 19, mahatiḥ kāryānu(ṇta)ram=bhūbhujām ¶ (¶) n=aiv=ānyaḥ para-  
kṛti-pālana-guṇo vyāçasyate kevalah | idṛçyāḥ(çyā:khalu  
ve(vai) sadā vanāratā[h\*] stutyā stute(tās)=tyā-
1. 20, ginaḥ ¶ Iti<sup>3</sup> kamala-dal-āmvu(mbu)-vindu-lolāni Çriyam=  
a[nu\*]cintya manuṣya-jivitañ=ca[†\*] sakalam=idam=udāhr-  
tañ=ca vudhivā(buddhivā) na hi puruṣail para-
1. 21, kirttayo vilopyāḥ | (¶) Jñātam=mahāmantri-çri-MĀHAKENA  
mahattara-çri-Vappeka-sutena[¶\*] Dūtako=tra mahāsā-  
manta-çri-GRAHAKUṆḢAḤ | (¶) Likhitañ=c=nitan=Mahā-
1. 22, nadi-putreṇa | Saiṅghapura-kāyastha-mahākṣapaṭalika-çri-  
VALADDUKEN=eti ¶ Samvat 921[¶\*] Yena<sup>4</sup> grāma-turaṅga-  
hema-surabhi-vastr-ādinā tarppitā viprā ye-
1. 23, na ca devatālaya-miṣeṇ=ākāri dharmm-occayaḥ | pūrṇṇani  
puṇya-jalais=tadāgam=akarod=yah kṣira-sindh-ūpamam  
ten=edaṁ nija-çāsanam karaṇika-çri-KEÇAVEN=ārjjitam
1. 24, ¶

<sup>1</sup> Metre Anuṣṭubh ; and of the next verse.

<sup>2</sup> Metre Çārdūlavikṛiḍita ; I am unable to correct all the mistakes occurring in  
this verse.      <sup>3</sup> Metre Puspitāgrā.      <sup>4</sup> Metre Çārdūlavikṛiḍita.

Under orders of the Council the following system of transliteration will be adopted for the future in all publications of the Society. Authors of papers for the *Journal*, Pt. I, are particularly requested to adhere to it in their contributions.

**A. FOR THE DĒVANĀGARĪ ALPHABET, AND FOR ALL ALPHABETS RELATED TO IT.**

अ a,	आ ā,	इ i,	ई ī,	उ u,	ऊ ū,	ए e,	ऐ ē,	ओ o,	औ ō,	ऐ ai,	औ au,	ँ ṁ,	ँ ṁ : ḥ
क k,	ख kh,	ग g,	घ gh,	ङ ṅ									
च c,	छ ch,	ज j,	झ jh,	ञ ñ									
ट t,	ठ th,	ड ḍ,	ढ ḍh,	ण ṇ									
त t,	थ th,	द ḍ,	ध dh,	न n									
प p,	फ ph,	ब b,	भ bh,	म m									
य y,	र r,	ल l,	व v,	(ळ l)									
श ṣ,	ष ṣ,	स s,	ह h.										

In the above the *virāma* has been omitted for the sake of clearness.

In Modern Vernaculars only; ङ may be represented by r, and ङ by rh.

*Avagraha* is to be represented by an apostrophe, thus सो ऽपि sō 'pi. *Visarga* is represented by ḥ, *Jihvāmūliya* by ḥ, and *Upadhmaniya* by ḥ. *Anusvāra* is represented by ṁ, thus संसर्गैः saṁsarga, and *anunāsika* by the sign ~ over the letter nasalized, thus आँ ā, आँ ā, and so on. The *udātta* accent is represented by the sign ' and the *svarita* by ^ . Thus, अग्निः agnih, जज्ञिता janitā, क्व क्वā, कन्या kanyā. The *anudātta* accent may be represented by ` . Thus, ते अवर्धन्ते tē āvardhanta.

**B. FOR PERSIAN (INCLUDING ARABIC WORDS IN PERSIAN) AND HINDŪSTĀNĪ.**

(The system is not applicable to Arabic when pronounced as in Arabic-speaking countries) :—

Vowels.	Consonants.	Sounds only found in Hindūstānī.
ī a	ب b	ب bh
ī ā	پ p	پ ph
ī i	ت t	ت th
و i		ف f
و ā		ث th
ī u	ع ʿ	
و ū	ج j	ج jh
و ō	ح h	ح ch

Vowels.	Consonants.	Sounds only found in Hindūstāni.
ای ai	ح h	
او au	خ <u>kh</u>	
	د d	د dh
		ذ d̤
		ذ̣ dḥ
	ذ z	
	ر r	ر r
		ر̣ rḥ
	ز z	
	ژ <u>zh</u>	
	س s	
	ش <u>sh</u>	
	ص ṣ	
	ز̣ ẓ	
	ط t	
	ظ ẓ	
	ع ʿ	
	غ <u>gh</u>	
	ف f	
	ق q	
	ک k	ک kh
	گ g	گ gh
	ل l	
	م m	
	ن n	
	و when representing <i>anunāsika</i> in Dēva Nāgarī, by ̣ on the preceding vowel	
	و w (or rarely v)	
	ه h	
	ی y	
	Hamzah ʾ (where necessary) ʾ	

The ʾ of the article ال in Arabic words should be assimilated before the solar letters; and the vowel *u* which often precedes the article and absorbs its vowel should remain attached to the word to which it belongs. Thus—اقبال الدولة Iqbālu-d-daulah.

*Tanwīn* may be rendered by *n*—e. g., *ittijāqan*. *Alif-i maqṣūrah* should be rendered by *ā*.

Final *z* need not be written in Persian and Hindūstāni words, but should be written in Arabic words.

*An Epigraphical Note on Palm-leaf, Paper and Birch-bark.*—By  
A. F. RUDOLF HOERNLE, PH.D., C.I.E.

[ Read May, 1898. ]

In his admirable summary of Indian Palæography which forms a part of the Encyclopædia of Indo-Aryan Research, the late Professor Bühler says (I translate from the German) that "it cannot be doubted but that the two large-leaved palms, the *tādātāla* (*Borassus flabelliformis*) and the *tādītālī* (*Corypha umbraculifera*, *C. taliera*) which probably were originally indigenous in South-India, but have now spread into the Panjāb, are those the leaves of which were principally employed" in India as writing-material (see § 37, C.). This statement, which merely repeats a general, oft-repeated opinion, is not quite accurate and therefore apt to mislead. It conveys the impression as if the leaves of those two palms had been used contemporaneously and indifferently throughout India. This is not correct. In preparing the introduction to my edition of the Bower Manuscript, I had occasion to specially enquire into this point. In the result I found (1) that up to a certain point of time, *Corypha umbr.* was the only palm, the leaves of which were used throughout India, and (2) that the use of the leaves of *Borassus fl.* commenced at a comparatively late period, and was, and is still, limited to the South and East of India. In the sequel I will try to show this. There are some minor inaccuracies in the above-quoted statement, which the following explanation will also set right.

The two Indian palms, which alone come into question in this connection, are (1) the (true) Talipat palm, *Corypha umbraculifera*, also *C. Taliera*; and (2) the Palmyra palm or Tarigach, *Borassus flabellifer*.<sup>1</sup>

<sup>1</sup> In Bengal the *Corypha umbr.* is called *Tedel*, while the *Borassus fl.* is called *Tāl*, and the proportion of the two palms is about 1 : 1000. The correct name of the *Borassus*, as Dr. Prain, the Superintendent of the Royal Botanic Gardens in Sibpur, informs me, is not *flabelliformis*, as usually given, but *flabellifer*, this being the name given to the palm by *Linnaeus* who first determined it. There is every

The former grows *wild* in Ceylon and on the Malabar coast, up to about the 13th Lat.; thence it freely grows *cultivated* up the west coast as far as the Concan (16th Lat.), and much less so as far as Bombay (19th Lat.); it also grows (but very uncommonly) *cultivated* up the whole of the East coast into Lower Bengal. It does not grow anywhere in the central part, or the high-lands of Southern India.

The *Borassus fl.* does not grow *wild* anywhere in India, but only *cultivated*, near villages. It grows throughout India, excepting only the Panjāb, Upper Sindh, and the northern-most portions of Rājputānā and of the North-West Provinces. In fact, its northern limit is (about) the 27th or 28th Lat.

The difference between these two palms is that whereas *Corypha umbr.* is *indigenous* to (Southern) India, *Borassus fl.* is an *introduced* tree, having been brought in from Africa, where it grows wild and is called *Deleb.* The above statements sum up the botanical information of the present day, which has been verified afresh for the purpose of the present paper by Dr. Prain, Superintendent of the Royal Botanic Gardens in Sibpur, near Calcutta.\* For his assistance, most kindly and readily given, in all matters touching the botany of these palms, I wish here to express my sincere thanks.

The leaves of the two palms can be easily distinguished from one another. Those of the *Corypha umbr.* are thinner and broader than those of the *Borassus fl.*; they also possess clearly marked cross-veins, in the form of rills, while the *Borassus* leaves rather present a pitted or pock-marked appearance. The width of the *Borassus* leaf never exceeds  $1\frac{1}{4}$ , and very rarely exceeds  $1\frac{1}{2}$  inches. Among all the cases that I have actually measured I have found the latter width only exceeded in three cases. These are No. 40 in Table II which measures  $1\frac{1}{2}$  inches, and Nos. 20 and 42 in Table II, which measure  $1\frac{2}{3}$  inches; all three being Southern Indian manuscripts. The majority of the *Borassus* manuscripts are something less than  $1\frac{1}{2}$  inches wide. A width of less than one inch is very rare; I have only met with it in two Southern Indian manuscripts, *viz.*, Nos. 18 and 37 in Table II, which measure only  $\frac{1}{2}$  of an inch.

The usual width of the *Corypha* leaf varies between  $1\frac{1}{2}$  and 3 inches. Among the inscribed leaves examined by myself, I have not

reason to believe that *C. Taliers* and *C. umbraculifera* are identical. I understand that Dr. Prain is preparing a monograph on the subject of these palms.

\* I should add, however, that, as I understand, more recent enquiries, made by Dr. Prain seem to render it doubtful whether even the *Corypha umbr.* grows *wild* anywhere in India or Ceylon. A very puzzling question then arises as to the real original home of that palm.

met with any wider than  $2\frac{1}{4}$  inches; though a few manuscripts which I have not seen are said to exist of the width of 3 inches (see Table III, No. 83). Manuscripts under  $1\frac{3}{4}$  inches wide are uncommon: instances are Nos. 15, 48, 57, 64 and 67 in Table I, and Nos. 4 and 8 in Table II. A width of less than  $1\frac{1}{2}$  inches is very exceptional. I have only found three cases, among all the manuscripts which I have measured; viz., No. 12 in Table II which is  $1\frac{3}{8}$  of an inch wide, and No. 55 in Table I and No. 5 in Table II, which are as low as  $1\frac{1}{4}$  inches. The width, therefore, is an almost absolute test; any leaf, measuring  $1\frac{3}{4}$  and upwards is certain to be *Corypha umbr.*, while any leaf measuring  $1\frac{1}{4}$  or below, is almost certain to be *Borassus fl.* With the width of about  $1\frac{1}{2}$  inches, there may occasionally be a doubt, but this will be removed by the application of the two additional tests of thickness and venation. In any case where the actual leaf can be examined, the three tests in combination are absolutely decisive. In almost all cases where the leaf itself can not be examined, its width, if recorded, will be found decisive. Thus in the case of Add. 1706 of the Cambridge MSS., probably of A. D. 1261 (Bendall, p. 199 and Table III, No. 57), the width of which is stated to be  $1\frac{1}{2}$  inches, I judged it to be a *Corypha* manuscript; and this was kindly verified for me by Professor Cowell by means of *Corypha* and *Borassus* specimens which I transmitted to him.

I have been speaking hitherto of the leaf in its prepared state as writing material. With regard to the natural leaf, which I had an opportunity of examining and measuring, with the kind assistance of Dr. Prain, in the Sibpur Botanic Gardens, the case stands as follows:—Both the *Corypha* and the *Borassus* palms, as is well-known, have plicate leaves folding like a fan, consisting of a number of segments. Through the middle of each segment, from end to end, runs a hard rib. The flaps on both sides of the rib are tough and flexible; and these yield the material which is prepared for writing purposes. They taper off from their widest point towards both ends; accordingly suitable strips are cut out from the middle, of such various lengths as the size of the natural half-segment will admit. These strips are prepared for writing, by boiling in water or milk; and finally, when wanted for writing a book, the required number of strips are cut down to a uniform size. Uniformity, however, was always more carefully attended to in point of length than in point of breadth. In manuscripts, of an older date especially, leaves of a much smaller breadth are occasionally mixed with others (forming the majority) which are much wider. Thus in No. 35 of Table I and Nos. 1, 4, 9, 10, 11 of Table II the occurrence of narrower leaves is indicated in brackets: they are occasionally found as narrow as  $1\frac{1}{8}$  inches.

The half-segment (that is a segment divided longitudinally along the central rib) of a *Borassus* leaf, at the point of its greatest width, may measure 2 inches, but it usually measures less. It tapers off very rapidly towards both ends; hence it is not possible to cut out from it a piece of practically uniform width of more than  $1\frac{1}{2}$  inches. A strip of about  $16 \times 1\frac{1}{2}$  inches is the largest that can be obtained. If a greater length is desired, consistent with uniform width, the latter will be smaller. From the usual size of the natural segment, however, only prepared strips of a smaller width than  $1\frac{1}{2}$  inches can be obtained. Occasionally the point of uniform width is neglected, and thus leaves are obtained measuring in length up to 20 inches, with a maximum width of  $1\frac{1}{2}$  inches. Examples are Nos. 77 and 87 in Table I, the width of which grows (as noted in the Table) from 1 or  $1\frac{1}{4}$  inches at the ends to  $1\frac{1}{2}$  inches in the middle of the leaf. As a rule, however, a prepared leaf, measuring a length of more than 16 inches, with a width of  $1\frac{1}{2}$  inches, is more likely to be a *Corypha* leaf.

The half-segment of a *Corypha* leaf, at its widest point, may measure three inches. I measured one leaf of this great size in the Sibpur Royal Botanic Gardens; but it is not improbable that leaves of this size may occur more commonly in Ceylon and Malabar, where the tree grows wild. A *Corypha* segment is much longer than a *Borassus* segment, and it tapers off far more gently, than the latter, from its widest point to its ends. Hence it is possible to cut much longer and wider strips from a *Corypha* segment. The largest manuscripts that I have measured are Nos. 30 and 34 in Table I, which measure  $32\frac{5}{8} \times 2\frac{1}{2}$  and  $33 \times 2\frac{1}{4}$  inches respectively. The length, however, may extend to 3 feet and more, and the width to 3 inches. The largest manuscript of which I know is No. 2068 in the Notices of Sanskrit MSS. It is said to measure  $40 \times 2$  inches (see Table III, No. 139, and footnote 11). The next largest are Nos. 262 and 289 (in Professor Peterson's Report for 1884–86, pp. 109 and 142; see also Table III, No. 72). They are said to measure  $37\frac{1}{2} \times 2\frac{1}{2}$  and  $37 \times 2\frac{1}{4}$  inches respectively. From the particular half segment which I measured to be 3 inches wide<sup>3</sup> strips measuring about  $2\frac{1}{2} \times 22$ , or  $2\frac{1}{4} \times 25$ , or  $2 \times 30$  inches might have been cut. On the other hand, I have also measured narrow specimens of natural *Corypha* segments which would only yield strips measuring  $16 \times 1\frac{1}{2}$  inches or even less. Examples of manuscripts of this kind are Nos. 48, 57, 67 in Table I and Nos. 4, 5, 8, 12 in Table II. Of course when strips of the great width of 3 inches were desired, one would usually

<sup>3</sup> The complete natural segment, of course, measured 6 inches across. Similarly the widest complete *Borassus* segment measures 4 inches across the widest point.



have had to be contented with but a short length. The only two manuscripts of this great width that I know are No. 187 in Professor Peterson's Third Report for 1884-86 (p. 8), and No. 58 in his Fifth Report for 1892-95 (p. 98, also Table III, No. 83), both of which are 3 inches broad. The former of these is only  $14\frac{1}{2}$  inches long. The latter (dated 1369 A.D.) is said to be 32 inches long, but I suspect that this is an error: its measures probably are  $12 \times 3$  or  $32 \times 2$ .<sup>4</sup> Corypha manuscripts of very great length, however, rarely possess an uniform width. Their leaves are cut from a whole half-segment; their maximum width is in the middle and it decreases towards both ends. A good example is No. 30 in Table I, some of the leaves of which slope from  $2\frac{1}{2}$  to  $1\frac{1}{2}$  inches. On the other hand, good examples of great length combined with practically uniform width are Nos. 34 and 36 in Table I, the breadth of which varies by no more than  $\frac{1}{4}$  inch or even less. Sometimes the half-segments of Corypha leaves were cut, across their breadth, into halves, and the strips for writing were cut from these halves. In this case, of course, the maximum width is at one end of the inscribed leaf, and gradually decreases to the other end. Examples of this kind are Nos. 2, 28, 32 in Table I, the leaves of which decrease from 2 to  $1\frac{3}{4}$ ,  $1\frac{1}{2}$  to  $1\frac{1}{4}$  and  $2\frac{1}{4}$  to  $1\frac{3}{4}$  inches respectively.

I may add that there is a kind of Corypha palm, the *Corypha elata*, which grows, probably *cultivated*, in Bengal and Bihār. But its leaves are not suitable for the purpose of writing books, and have never been so used. Its complete natural segments are much too narrow; they measure only about  $1\frac{1}{2}$  inches, and allow only strips of  $\frac{3}{4}$  inch or less to be cut from them.

Having premised this much, I may now proceed to state that I have examined the actual or facsimile leaf of 130 manuscripts. They are

<sup>4</sup> Another clear instance of an error is in the record of No. 86 (Fifth Report, p. 136). This MS., dated 1241 A.D., is said to be of palm-leaf and to measure  $16 \times 4$  inches. This width of 4 inches, for a palm-leaf MS., is an impossibility; it would indicate a natural segment of the width of at least 8 inches!! Prof. Bhandarkar, whom I consulted, writes to me: "There must be some mistake about the breadth of the leaves of No. 86. I have seen the MSS. in the Deccan College and a good many at Pātān, perhaps the same as those catalogued by Dr. Peterson, but I do not remember having seen any leaves of that breadth. Dr. Peterson's cataloguing work was done by clerks and agents, and it is not unlikely that it was not done with the scrupulous care of the scientific scholar." The measures would suit a paper MS.; and that possibly is the solution of the error. There is a similar error in Bendall's Catalogue of the Cambridge MSS. Here Add. 1633 is described as a palm-leaf MS. of the extraordinary breadth of 5 inches. It is, however, a Paper MS., as I am informed by Professor Cowell, who, at my request, very kindly inspected the manuscript.

shown in the subjoined Tables I and II, with 87 and 43 Nos. respectively. Table I contains manuscripts, of which the date is known, while Table II contains manuscripts of conjectural dates. The lists are not selected ones in any other sense than that I have included in it none but such manuscripts as I have actually seen and examined myself, and thus determined the palm to which their leaves belong. Those manuscripts (27 out of 130) of which I have seen leaves only in photographic facsimile are marked with an asterisk. The manuscripts marked "Kielhorn" and "Bhandarkar" are preserved in the Deccan College in Poona. The opportunity of inspecting them I owe to the kindness of Mr. Giles, Director of Public Instruction in Bombay, and Professor Abaji Kathavate of the Deccan College, who transmitted specimen leaves to me. The numbers refer to the Reports on the Search of Sanskrit MSS. in the Bombay Presidency for 1880-81 and 1887-91. The Tanjore manuscripts, which are referred to by their numbers in Burnell's Classified Catalogue, were transmitted to me by Mr. Geo. T. Oliver, the Receiver and Manager of the Tanjore Palace Estate; so were those, marked "in private hands," by Maulvi Muhammad Abdullah, an officer of the Darbhanga Rāj. To both these gentlemen I wish here to express my sincere thanks. Nearly the whole of the remainder of the list are manuscripts preserved in Calcutta in the collections of the Asiatic Society of Bengal and the Government of India. They are referred to as "Mitra," "Ind. Govt." and "Notices." These, of course, I had no difficulty in inspecting. My friends, Mahā-mahōpadhyāya Pandit Hara Prasad Shastri, and Muni Hans Vijay-ji, the head of one of the Jain Ḍākḥās, were also kind enough to let me see a few palm-leaf manuscripts in their possession. I may add that the measurements of all the manuscripts in the two lists have been made or verified by myself.

TABLE I.<sup>5</sup>

No.	A. D.	Date.	Reference.	Loc.	Mat.	Measure.
1	[450]		Fragments, J. A. S. B.	W. Ind.	Cor.	9 × 2
2*	[520]		Horiuzi.	W. Ind.	Cor.	11 × 2 to 1½
3*	[550]		Add. 1702, Bendall.	W. Ind.	Cor.	12 × 2
4*	859	Harṣa 252.	Add. 1049, Bendall.	W. Ind.	Cor.	16 × 2
5*	1008	Nep. 128.	Add. 866, Bendall.	Nep.	Cor.	21 × 2
6	1014	Nep. 134.	No. 3328, Ind. Govt.	Nep.	Cor.	12½ × 2½
7*	1015	Nep. 135.	Pal. Soc., No. XXI.	Nep.	Cor.	21½ × 2½
	1020	5 Mahipāla.	Add. 1464, Bendall.	Bih.	Cor.	21 × 2½
	1026	Nep. 146.	See No. 6 above.		Cor.	
9	1071	Nep. 191.	A 15, Mitra.	Nep.	Cor.	22½ × 2½
10	1078	Nep. 198.	No. 3830, Ind. Govt.	Nep.	Cor.	18 × 1½
11*	1084	Nep. 204.	Pal. Soc., No. XVII.	Nep.	Cor.	12 × 2
12	1089	Sam. 1145.	No. 35, Kielhorn.	W. Ind.	Cor.	25½ × 2½
13	1090	Sam. 1146.	No. 36, do.	W. Ind.	Cor.	25½ × 2½

<sup>5</sup> About No. 6 see *Journal, As. Soc. Beng.*, Vol. LXII (1893), p. 252. The MS. has two dates; viz., N. S. 134 on the outside of the first written leaf, and N. S. 146 in the colophon, on the last leaf. These are probably the dates of beginning and finishing the copy. There are similarly two dates on No. 50; viz., Lakṣ. 374 and Çak 1423. As to No. 72 I may note that under No. 2126 of the "Notices" two manuscripts are described. The Government manuscript is a Corypha MS., and is entered here in Table I. The other manuscript, which I have not seen, is entered in Table III, No. 128; and to judge from its measurements, it is a Borassus MS. The date of the Government manuscript, however, is *çakābdāḥ* | 16 | | with a lacuna for the units and tens, which may mean 1600 as Dr. Mitra assumed; but it may be also a later date. The measurements of Nos. 26 and 41 have been kindly verified for me by the Honorary Librarian of the Royal Asiatic Society. Some leaves of Nos. 39 and 42 are much narrower, viz., 32 × 1½ (1) and 15 × 1½ (1½) respectively. The equation of the dates of the Lakṣmāpiya Era has been made with 1105, the present year 1898 being = 793 L. E., and the 1st year of that era running from the 15 Jan., 1106, to the 15th January, 1107. No. 65 is dated Çaka 1555 and San 1041. The latter date refers to the Faḥli Era of Bengal, and is = 1633 A.D.; see Cunningham's *Book of Indian Eras*, p. 82. "Pal. Soc." refers to the Publications of the London Palaeographical Society. In the case of a few manuscripts, such as No. 17, 55, etc., the length is not given by me, because at the time I examined them, I forgot to take a note of it.

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
14 <sup>6</sup>	1116	Sam. 1172.	Muni Hans Vijay-ji.	W. Ind.	Cor.	29 × 2½
15	1120	Sam. 1176.	No. 53, Kielhorn.	W. Ind.	Cor.	13 × 1½
16	1120	15 Rāma- pāla.	In my possession.	Bih.	Cor.	22 × 2¼
17	1130	Nep. 250.	With H. P. Shāstri.	Nep.	Cor.	2
18*	1132	Sam. 1189.	With Prof. Bühler.	N. Ind.	Cor.	2
19	113[8]	Sam. 119*.	No. 58, Kielhorn.	W. Ind.	Cor.	28 × 2½
20*	1165	Nep. 285.	Add. 1693, Bendall.	Nep.	Cor.	16 × 2½
21*	1165	4 Gōvinda- pāla.	No. 1, R. As. Soc.	Bih.	Cor.	22½ × 2½
22*	1166	Nep. 286.	No. 2, R. As. Soc.	Nep.	Cor.	22½ × 2
23*	1167	Nep. 287.	Add. 1686, Bendall.	Nep.	Cor.	11 × 2
24*	1179	Nep. 299.	Add. 1691, Bendall.	Nep.	Cor.	12 × 2
25	1185	24 Govinda- pāla.	No. 3822, Ind. Govt.	Bih.	Cor.	11½ × 2
26*	1198	Nep. 316.	No. 69, R. As. Soc.	Nep.	Cor.	12¼ × 2
27*	1199	38 Gōvinda- pāla.	Add. 1699, Bendall.	Bih.	Cor.	11½ × 2½
28	1208	Sam. 1264.	No. 8, Kielhorn.	W. Ind.	Cor.	13½ × 1¼ to 1½
29*	1229	Çak. 1151.	Pal. Soc., No. I.		Cor.	17½ × 2½
30	1238	Sam. 1294.	No. 38, Kielhorn.	W. Ind.	Cor.	32½ × 2½ to 1½
31	1276	Sam. 1332.	No. 3, do.	W. Ind.	Cor.	14½ × 2½
32	1284	Sam. 1340.	No. 60, do.	W. Ind.	Cor.	15 × 2½ to 1½
33*	1286	Nep. 406.	Pal. Soc., No. XXXII.	Nep.	Cor.	13 × 2¼
34*	1291	Sam. 1348.	Pal. Soc., No. LVIII.		Cor.	33 × 2¼
35	1297	Kal. 4398.	No. 34, Kielhorn.	W. Ind.	Cor.	14½ × 1½ (1¼)
36	1303	Sam. 1359.	No. 37, do.	W. Ind.	Cor.	30½ × 2¼

<sup>6</sup> This is a manuscript written by Açōka Candra and Dhanēçvara Sādbu, and corrected by Vardhamāna Sūri (apparently the author), Nēmicandra Muniçvara, and Pārçvacandra Upādhyāya. The name of the work is Dharma Karaṇḍaka Sūtra Ṭikā, and its author is Vardhamāna Sūri, a pupil of Abhayadēva Sūri. Its date is given in the following çloka: *vikramatō varṣāṇām çatēṣu = èkādaçasv = atitēṣu | dvā-saptatyā varṣair = adhikēṣu kṛtā vikṛtir = èṣā |*

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
37	1319	Lakṣ. 214.	In private hands.	Bih.	Cor.	$15\frac{1}{2} \times 1\frac{1}{2}$
38	1331	Nep. 451.	No. 3824, Ind. Govt.	Nep.	Cor.	$12 \times 2$
39	1340	Sam. 1396.	Muni Hans Vijay-ji.	W. Ind.	Cor.	$32 \times 2\frac{3}{16}(1\frac{1}{2})$
40	1356	Nep. 476.	No. 3823, Ind. Govt.	Nep.	Cor.	$11\frac{1}{2} \times 2$
41*	1364	Nep. 484.	No. 74, R. As. Soc.	Nep.	Cor.	$12\frac{1}{2} \times 1\frac{1}{2}$
42	1368	Sam. 1424.	Muni Hans Vijay-ji.	W. Ind.	Cor.	$15 \times 2\frac{1}{2}(2)$
43*	1372	Nep. 492.	Pal. Soc., No. LVII.	Nep.	Cor.	$20\frac{1}{2} \times 2\frac{3}{8}$
44*	1385	Nep. 505.	Add. 1395, Bendall.	Nep.	Cor.	$13\frac{1}{2} \times 2$
45	1386	Sam. 1442.	No. 1980, Notices.	Beng.	Cor.	$11 \times 2$
46	1395	Nep. 515.	Ind. Govt.	Nep.	Cor.	$13\frac{1}{2} \times 1\frac{1}{2}$
47*	1446	Sam. 1503.	Pal. Soc., No. XXXIII.	Bih.	Cor.	$13\frac{1}{2} \times 2\frac{1}{2}$
48	1450	Lakṣ. 345.	In private hands.	Bih.	Cor.	$13 \times 1\frac{1}{2}$
49	1467	Lakṣ. 362.	No. 3821, Ind. Govt.	Bih.	Cor.	$13 \times 2$
50	1479	Lakṣ. 374.	No. 4026, Ind. Govt.	Bih.	Cor.	$11\frac{1}{2} \times 2$
	1507	Çak. 1423.	See No. 50 above, and footnote 5.			
51	1504	Lakṣ. 399.	No. 1979, Notices.	Bih.	Cor.	$14\frac{1}{2} \times 2\frac{1}{2}$
52	1513	Lakṣ. 408.	In private hands.	Bih.	Cor.	$18\frac{1}{2} \times 1\frac{1}{2}$
53	1514	Çak. 1436.	No. 1273 Notices.	Beng.	Cor.	$14\frac{1}{2} \times 1\frac{1}{2}$
54	1531	Çak. 1453.	No. 1165 do.	Beng.	Cor.	$13\frac{1}{2} \times 2$
55	1553	Çak. 1475.	H. Prasāda Shāstri.	Beng.	Cor.	$1\frac{1}{2}$
56*	1557	Lakṣ. 452.	Pal. Soc., No. LXXXII.	Bih.	Cor.	$13\frac{3}{8} \times 2$
57	1572	Çak. 1494.	No. 1274, Notices.	Beng.	Cor.	$13\frac{1}{2} \times 1\frac{1}{2}$
58	1575	Lakṣ. 470.	In private hands.	Bih.	Cor.	$13\frac{1}{2} \times 2\frac{1}{2}$
59*	1583		Add. 1556, Bendall.		Cor.	$2\frac{1}{2}$
60	1587	Çak. 1509.	No. 1976, Notices.	Beng.	{ Cor. } { Bor. }	$12 \times \left\{ \begin{array}{l} 1\frac{1}{2} \\ 1\frac{1}{2} \end{array} \right\}$
61	1594	Çak. 1516.	No. 1975 do.	Beng.	Bor.	$12 \times 1\frac{1}{2}$
62	1608	Lakṣ. 503.	In private hands.	Bih.	Cor.	$13\frac{1}{2} \times 1\frac{1}{2}$
63	1609	Lakṣ. 504.	do.	Bih.	Cor.	$13\frac{1}{2} \times 2$

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
64	1616	Lakṣ. 511.	In private hands.	Bih.	Cor.	14½ × 1½
65	1633	Çak. 1555.	do.	Bih.	Cor.	12 × 1½
66	1647	Çak. 1569.	do.	Bih.	Cor.	11½ × 2
67	1661	Lakṣ. 556.	do.	Bih.	Cor.	12½ × 1½
68	1668	Çak. 1590.	do.	Bih.	Cor.	7½ × 1½
69	1669	Çak. 1591	do.	Bih.	Cor.	7 × 1½
	1660	Lakṣ. 555				
70	1675	Çak. 1597.	H. Prasāda Shāstri.	Beng.	Bor.	1½
71	1677	Çak. 1599.	do. do.	Beng.	Bor.	1½
72	1678	Çak. 1600.	No. 2126, Notices.	Beng.	Cor.	15½ × 2
73	1680	Çak. 1602.	In private hands.	Bih.	Cor.	14 × 1½
74	1683	¼ Mukunda.	Ind. Govt.	Oris.	Bor.	? × 1½
75	1683	¼ Mukunda.	do.	Oris.	Bor.	15 × 1½
76	1687	Çak. 1609.	No. 1551, Notices.	Beng.	Bor.	11 × 1½
77	1688	Çak. 1610.	No. 1550 do.	Beng.	Bor.	20 × 1½ to 1
78	1689	Çak. 1611.	No. 1580 do.	Beng.	Bor.	14½ × 1½
79	1690	¼ Mukunda.	No. 2837, do.	Oris.	Bor.	16 × 1½
80	1694	Çak. 1616.	No. 10040, Tanjore.	S. Ind.	Bor.	10½ × 1½
81	1708	17 Divya-Simha.	Ind. Govt.	Oris.	Bor.	15½ × 1½
82	1721	Çak. 1643.	H. Prasāda Shāstri.	Beng.	Cor.	2½
83*	1724		Burnell, S. Ind. Pal.	S. Ind.	Cor.	15½ × 2½
84	1739	Çak. 1661.	No. 1845, Notices.	Bih.	Cor.	15½ × 2
85	1752	10 Kṣçari-Dēva.	Ind. Govt.	Oris.	Bor.	14½ × 1½
86	1766	24 do.	do.	Oris.	Bor.	15 × 1½
87	1815	Çak. 1737.	No. 1607, Notices.	Beng.	Bor.	14½ × 1½ to 1

All manuscripts in the foregoing Table (with the exception of Nos. 1-3) bear an actual date. The following Table II includes manuscripts the approximate date of which can be fixed with some degree of certainty. This has been done by myself, mainly on palæographic grounds, in all cases except those marked with the letter B. The date

of the latter is that given to them by Dr. Burnell in his *Classified Catalogue of Tanjore Manuscripts*.

TABLE II.

No.	A. D.	Reference.	Loc.	Mat.	Measure.
1	1150	No. 44, Kielhorn.	W. Ind.	Cor.	$14\frac{1}{2} \times 1\frac{7}{8}$ ( $1\frac{1}{2}$ )
2	1150	No. 46 do.	W. Ind.	Cor.	$29\frac{1}{2} \times 1\frac{1}{2}$
3	1200	No. 33 do.	W. Ind.	Cor.	$15 \times 1\frac{1}{2}$
4	1200	No. 68 do.	W. Ind.	Cor.	$12\frac{1}{2} \times 1\frac{1}{2}$ ( $1\frac{1}{2}$ )
5	1225	No. 40 do.	W. Ind.	Cor.	$11 \times 1\frac{1}{2}$
6	1250	No. 32 do.	W. Ind.	Cor.	$12\frac{1}{2} \times 1\frac{1}{8}$
7	1250	No. 69 do.	W. Ind.	Cor.	$14\frac{1}{2} \times 2$
8	1300	No. 30 do.	W. Ind.	Cor.	$12\frac{1}{2} \times 1\frac{1}{2}$
9	1300	No. 63 do.	W. Ind.	Cor.	$14\frac{1}{2} \times 1\frac{1}{2}$ ( $1\frac{1}{2}$ )
10	1325	No. 20 do.	W. Ind.	Cor.	$12\frac{1}{2} \times 1\frac{1}{2}$ ( $1\frac{1}{2}$ )
11	1375	No. 67 do.	W. Ind.	Cor.	$14 \times 2$ ( $1\frac{1}{2}$ )
12	1525	No. 1062 Bhandarkar.	S. Ind.	Cor.	$14 \times 1\frac{1}{2}$
13*	1550	Pal. Soc., No. LXX.	S. Ind.	Bor.	$14 \times 1\frac{1}{2}$ (B)
14 <sup>7</sup>	1550	No. 1056, Bhandarkar.	S. Ind.	Cor.	$19 \times 2$
15*	1550	No. 11894, Tanjore.	S. Ind.	Bor.	$18\frac{1}{2} \times 1\frac{1}{2}$ (B)
16	1580	No. 10093 do.	S. Ind.	Bor.	$16 \times 1\frac{5}{8}$ (B)
17	1600	No. 1061, Bhandarkar.	S. Ind.	Cor.	$17\frac{1}{2} \times 2$
18	1600	No. 9075, Tanjore.	S. Ind.	Bor.	$17 \times 1\frac{1}{8}$ (B)
19	1600	No. 10511 do.	S. Ind.	Bor.	$11\frac{1}{2} \times 1\frac{5}{8}$ (B)
20	1600	No. 9997 do.	S. Ind.	Bor.	$18\frac{1}{2} \times 1\frac{7}{8}$ (B)
21	1620	No. 9140 do.	S. Ind.	Bor.	$18 \times 1$ (B)
22	1620	No. 10288 do.	S. Ind.	Bor.	$18\frac{1}{2} \times 1\frac{1}{2}$ (B)
23	1625	No. 10869 do.	S. Ind.	Bor.	$15 \times 1$ (B)

<sup>7</sup> The inner leaves of this manuscript are old. The outer ones, at the beginning and end, are larger ( $20\frac{1}{2} \times 2\frac{1}{2}$ ) and of a much more modern date (about 1700 A.D.). I examined the leaves numbered 1,105 and 260.

No.	A.D.	Reference.	Loc.	Mat.	Measure.
24	1650	No. 1060, Bhandarkar.	S. Ind.	Cor.	$19\frac{1}{2} \times 2\frac{1}{2}$
25	1650	No. 9710, Tanjore.	S. Ind.	Cor.	$13\frac{1}{2} \times 2$
26	1650	No. 9908 do.	S. Ind.	Cor.	$18\frac{1}{2} \times 2\frac{1}{2}$
27	1650	No. 9066 do.	S. Ind.	Bor.	$16 \times 1\frac{1}{2}$ (B)
28	1650	No. 9185 do.	S. Ind.	Bor.	$15 \times 1\frac{1}{2}$ (B)
29	1650	No. 9760 do.	S. Ind.	Bor.	$15\frac{1}{2} \times 1\frac{1}{8}$ (B)
30	1650	No. 9076 do.	S. Ind.	Bor.	$15\frac{1}{2} \times 1\frac{1}{2}$ (B)
31*	1670	No. 9531 do.	S. Ind.	Bor.	$19\frac{1}{2} \times 1\frac{1}{8}$ (B)
32	1700	No. 989, Bhandarkar.	S. Ind.	Bor.	$13\frac{1}{2} \times 1\frac{1}{2}$
33	1700	No. 9169, Tanjore.	S. Ind.	Cor.	$16 \times 2\frac{1}{2}$ (B)
34	1700	No. 9605 do	S. Ind.	Cor.	$12 \times 1\frac{1}{2}$
35	1700	No. 9870 do.	S. Ind.	Cor.	$14 \times 2$
36	1700	No. 9960 do.	S. Ind.	Bor.	$15\frac{1}{2} \times 1\frac{1}{8}$ (B)
37	1700	No. 9935 do.	S. Ind.	Bor.	$16\frac{1}{2} \times 1\frac{1}{8}$ (B)
38	1700	No. 10910 do.	S. Ind.	Bor.	$14\frac{1}{2} \times 1\frac{1}{8}$ (B)
39	1720	No. 8974 do.	S. Ind.	Bor.	$18\frac{1}{2} \times 1$ (B)
40	1720	No. 10868 do.	S. Ind.	Bor.	$17\frac{1}{2} \times 1\frac{1}{2}$ to $1\frac{1}{8}$ (B)
41	1750	No. 9098 do.	S. Ind.	Bor.	$14\frac{1}{2} \times 1\frac{1}{8}$ (B)
42	1750	No. 9739 do.	S. Ind.	Bor.	$12\frac{1}{2} \times 1\frac{1}{8}$ (B)
43	1750	No. 10786 do.	S. Ind.	Bor.	$16\frac{1}{2} \times 1\frac{1}{2}$ (B)

In the following remarks my arguments will be based entirely on the information furnished by Table I. The information of Table II will be used only as subsidiary and corroborative evidence.

Further, for the present, my remarks will be limited entirely to the conditions obtaining in Northern India, *i.e.*, broadly speaking North of the 20th degree of latitude. The case of Southern India will be considered later on.

The first point, very clearly brought out by Table I, is the exclusive use of *Corypha* leaves throughout Northern India, up to the latter part of the 17th century A.D. A very marked change begins with 1675 A.D. Before that date (with one exception, No. 60, which I shall



presently refer to) all dated manuscripts are uniformly written on *Corypha* leaves. From 1675 A.D. the use of the *Borassus* leaf almost entirely supersedes that of the *Corypha* leaf. Commencing with that year there are 18 manuscripts examined by me. Two of these are South-Indian which must be excluded. Of the remaining 16 manuscripts 12 are written on *Borassus* leaves, and only 4 on *Corypha* leaves; that is to say, 75 per cent. are *Borassus* manuscripts.

In order to appreciate the very effective character of the evidence of Table I, let it be noted that, between the years 1000 and 1770, there is a total of 77 decades, of which not less than 51 are represented in the Table by one or more manuscripts. The 14th and 17th centuries are the best represented, every decade appearing in the Table, except those beginning with 1320, 1620 and 1650. The 15th century is the worst represented, as the decades beginning with 1400, 1410, 1420, 1430, 1480 and 1490 are wanting. The effectiveness of the representation is corroborated by Table II, which, it may well be assumed, would have filled up many gaps in the 12th, 13th and 14th centuries, if the exact dates of the manuscripts listed in it were known. The effectiveness will be found still more corroborated by the exact dates given in Table III. With Tables I and III combined, there remain only 9 decades unrepresented; *viz.*, those beginning with 1040, 1100, 1140, 1150, 1430, 1480, 1650, 1710, and 1740, and some of these probably are covered by Table II.

There are only two manuscripts dating before 1675 A.D., which are written on *Borassus* leaves. These are Nos. 60 and 61, belonging to 1587 and 1594 A.D. respectively. No. 61 is written wholly on *Borassus* leaves; while No. 60 is only so partially: the body of it is written on *Corypha* leaves, while the end is on a *Borassus* leaf. These are exceptional cases: they only indicate, as I shall show further on, that the use of *Borassus* leaves first began in a sporadic form in Southern Bengal. But for Northern India generally, Table I shows that we may take the year 1675 A.D. as the epoch that marks the change from the use of *Corypha* to that of *Borassus*.

Before proceeding further, it may be as well at once to meet an objection that might suggest itself. It appears to be believed that *Borassus* leaves are much less durable than *Corypha* leaves. This may or may not be true: I have no special evidence on the subject. But Dr. Burnell in his *South-Indian Palaeography* (2nd ed.), p. 41, says: "It is hopeless to look for old specimens, as palm-leaf MSS. perish rapidly in the Tamil country, where they are mostly written on leaves of the '*Borassus flabelliformis*,' far inferior to the *Talipat* leaves in beauty and durability." So also Mr. Simon de Silva, Mudaliyar, in Colombo informs me that "the *Talipat* leaf is preferred for the purpose

of book writing on account of its durability and polish." These observations may be true with regard to Southern India and Ceylon; they would probably also apply to Bengal and Orissa with their equally damp climate; but would hardly apply to the rest of Northern India with its far drier climate. But be that as it may, I have drawn up Table III for the purpose of showing how little probability there is that all Borassus MSS., dating before 1675 A.D., may have perished on account of their inferior durability, or that, by some unaccountable and improbable chance, none of them may have fallen into my hands when making up Table I.

TABLE III.

No.	A. D.	Date.	Reference.	Loc.	Mat.	Measure.
1	1039	Nep. 159.	Add. 1683, Bendall.	Nep.	Cor.	21 × 2
2	1054	14 Nayapāla.	Add. 1688 do.	Bih.	Cor.	22 × 2
3	1065	Nep. 185.	Add. 1684 do.	Nep.	Cor.	21 × 2
4	1668	Nep. 188.	Add. 1680 do.	Nep.	Cor.	11 × 2
5	1098	Sam. 1154.	Peterson <sup>5</sup> , No. 13.	W. Ind.	(Cor.)	73 × 1½
6	1123	Sam. 1179.	Kielhorn, No. 42.	W. Ind.	Cor.	13 × 2½
7	1125	Sam. 1181.	Peterson <sup>5</sup> , No. 229.	W. Ind.	Cor.	13½ × 1½
8	1125	Sam. 1181.	Peterson <sup>5</sup> , No. 66.	W. Ind.	(Cor.)	12 × 1½
9	1130	Sam. 1186.	do. No. 40.	W. Ind.	Cor.	10 × 1½
10	1130	Sam. 1186.	do. No. 63.	W. Ind.	(Cor.)	13 × 1
11	1131	Sam. 1187.	do. No. 36.	W. Ind.	Cor.	27 × 2½.
12	1162	Sam. 1218.	do. No. 31.	W. Ind.	Cor.	14 × 2
13	1162	Sam. 1218.	Kielhorn, No. 13.	W. Ind.	Cor.	29 × 2½
14	1165	Nep. 285.	Add. 1693, Bendall.	Nep.	Cor.	17 × 2½
15	1165	Sam. 1221.	Peterson <sup>5</sup> , No. 240.	W. Ind.	Cor.	27 × 2½
16	1173	Sam. 1229.	do. No. 215.	W. Ind.	Cor.	14½ × 1½
17	1175	Sam. 1231.	Peterson <sup>5</sup> , No. 1.	W. Ind.	Cor.	12 × 1½
18	1191	Sam. 1247.	Peterson <sup>5</sup> , No. 225.	W. Ind.	Cor.	13½ × 1½
19	1193	Sam. 1249.	do. No. 309.	W. Ind.	Cor.	29 × 2½

No.	A. D.	Date.	Reference.	Loc.	Mat.	Measure.
20	1199	Nep. 319.	Add. 1657, (2), Bendall.	Nep.	Cor.	12 × 2
21	1202	Sam. 1258.	Peterson <sup>5</sup> , No. 65.	W. Ind.	Cor.	12 × 1½
22	1204	Sam. 1260.	Peterson <sup>8</sup> , No. 189.	W. Ind.	Cor.	15½ × 1½
23	1205	Sam. 1261.	do. No. 220.	W. Ind.	Cor.	33½ × 2½
24	1205	Nep. 325.	Add. 1644, Bendall.	Nep.	Cor.	21 × 2
25	1207	Sam. 1263.	Peterson <sup>8</sup> , No. 198.	W. Ind.	Cor.	10½ × 1½
26	1215	Sam. 1271.	Peterson <sup>5</sup> , No. 80.	W. Ind.	Cor.	16½ × 1½
27	1228	Sam. 1284.	do. No. 78.	W. Ind.	Cor.	11 × 2½
28	1228	Sam. 1284.	Peterson <sup>8</sup> , No. 226.	W. Ind.	Cor.	14 × 2½
29	1230	Sam. 1286.	do. No. 288.	W. Ind.	Cor.	34½ × 2½
30	1231	Sam. 1287.	do. No. 266.	W. Ind.	Cor.	15½ × 1½
31	1232	Sam. 1288.	Peterson <sup>5</sup> , No. 55.	W. Ind.	Cor.	15 × 2
32	1235	Sam. 1291.	Peterson <sup>8</sup> , No. 320.	W. Ind.	Cor.	36 × 2½
33	1236	Sam. 1292.	do. No. 217.	W. Ind.	Cor.	33½ × 2½
34	1236	Sam. 1292.	do. No. 300.	W. Ind.	Cor.	36 × 2½
35	1236	Sam. 1292.	do. No. 277.	W. Ind.	Cor.	15½ × 2
36	1237	Sam. 1293.	do. No. 267.	W. Ind.	Cor.	14½ × 1½
37	1237	Sam. 1293.	Peterson <sup>5</sup> , No. 46.	W. Ind.	Cor.	12 × 1½
38	1238	Sam. 1294.	do. No. 34.	W. Ind.	Cor.	29 × 2½
39	1238	Sam. 1294.	Peterson <sup>8</sup> , No. 186.	W. Ind.	Cor.	14½ × 2
40	1238	Sam. 1294.	do. No. 275.	W. Ind.	Cor.	29½ × 2½
41	1240	Sam. 1296.	do. No. 202.	W. Ind.	Cor.	12½ × 1½
42	1240	Sam. 1296.	do. No. 250.	W. Ind.	Cor.	34½ × 2
43	1240	Sam. 1296.	Peterson <sup>5</sup> , No. 26.	W. Ind.	Cor.	32 × 2½
44	1242	Sam. 1298.	Peterson <sup>8</sup> , No. 319.	W. Ind.	Cor.	34½ × 2½
45	1243	Sam. 1299.	do. No. 276.	W. Ind.	Cor.	34 × 2½
46	1244	Sam. 1300.	Kielhorn, No. 47.	W. Ind.	Cor.	18½ × 2
47	1245	Sam. 1301.	Peterson <sup>8</sup> , No. 219.	W. Ind.	Cor.	33½ × 2½

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
48	1245	Sam. 1301.	Peterson <sup>8</sup> , No. 337.	W. Ind.	Cor.	32½ × 2
49	1245	Sam. 1301.	do. No. 247.	W. Ind.	Cor.	34½ × 2½
50	1247	Sam. 1303.	do. No. 286.	W. Ind.	Cor.	15½ × 2
51	1248	Sam. 1304.	Kielhorn, No. 28.	W. Ind.	Cor.	15 × 2
52	1251	Sam. 1307.	Peterson <sup>8</sup> , No. 235.	W. Ind.	Cor.	28½ × 2½
53	1253	Sam. 1309.	do. No. 283.	W. Ind.	Cor.	18 × 2
54	1253	Sam. 1309.	do. No. 310.	W. Ind.	Cor.	32½ × 2
55	1258	Sam. 1314.	do. No. 222.	W. Ind.	Cor.	23½ × 2
56	1259	Sam. 1315.	Kielhorn, No. 62.	W. Ind.	Cor.	14½ × 2
57	1261	Nep. 381.	Add. 1706, Bendall.	Nep.	Cor.	11½ × 1½
58	1261	Sam. 1317.	Peterson <sup>8</sup> , No. 8.	W. Ind.	Cor.	17 × 2
59	1264	Sam. 1320.	do. No. 59.	W. Ind.	Cor.	33 × 2
60	1264	Nep. 384.	Add. 1465, Bendall.	Nep.	Cor.	13 × 2
61	1266	Sam. 1322.	Peterson <sup>8</sup> , No. 260.	W. Ind.	Cor.	32½ × 2½
62	1269	Sam. 1325.	do. No. 199.	W. Ind.	Cor.	17½ × 1½
63	1270	Sam. 1326.	do. No. 231.	W. Ind.	Cor.	28½ × 2½
64	1271	Sam. 1327.	do. No. 256.	W. Ind.	Cor.	33½ × 2½
65	1272	Sam. 1328.	do. No. 290.	W. Ind.	Cor.	27 × 2
66	1275	Sam. 1331.	Peterson <sup>8</sup> , No. 35.	W. Ind.	Cor.	32 × 2½
67	1280	Sam. 1336.	do. No. 32.	W. Ind.	Cor.	15 × 2
68	1286	Sam. 1342.	Kielhorn, No. 5.	W. Ind.	Cor.	32½ × 2½
69	1287	Sam. 1343.	Peterson <sup>8</sup> , No. 27.	W. Ind.	Cor.	31½ × 2
70	1302	Nep. 422.	Add. 1306, Bendall.	Nep.	Cor.	13 × 2
71	1303	Sam. 1359.	Kielhorn, No. 37.	W. Ind.	Cor.	30½ × 2½
72	1320	Sam. 1376.	Peterson <sup>8</sup> , No. 262.	W. Ind.	Cor.	37½ × 2½
73	1324	Sam. 1380.	do. No. 253.	W. Ind.	Cor.	33 × 2½
74	1327	Sam. 1383.	do. No. 285.	W. Ind.	Cor.	19½ × 2
75	1331	Sam. 1387.	do. No. 259.	W. Ind.	Cor.	35½ × 2½

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
76	1334	Sam. 1390.	Peterson <sup>5</sup> , No. 84.	W. Ind.	Cor.	17 × 2½
77	1335	Sam. 1391.	Peterson <sup>5</sup> , No. 295.	W. Ind.	Cor.	35½ × 2½
78	1336	Sam. 1392.	Peterson <sup>5</sup> , No. 77.	W. Ind.	Cor.	15 × 2
79	1342	Sam. 1398.	do. No. 85.	W. Ind.	Cor.	17 × 2
80	1355	Nep. 475.	Add. 1697, (viii), Bendall.	Nep.	Cor.	12 × 2
81	1360	Nep. 480.	Add. 1409, Bendall.	Nep.	Cor.	13 × 2
82	1360	Sam. 1416.	Notices, No. 3308.	Beng.	Cor.	10 × 1½
83	1369	Sam. 1425.	Peterson <sup>5</sup> , No. 58.	W. Ind.	Cor.	32 × 3
84	1374	Nep. 494.	Add. 1689, Bendall.	Nep.	Cor.	16 × 2
85	1380	Nep. 500.	Add. 1685 do.	Nep.	Cor.	13½ × 2
86	1384	Nep. 504.	Add. 1488 do.	Nep.	Cor.	9 × 2
87	1386	Nep. 506.	Add. 1698 do.	Nep.	Cor.	13 × 2
88	1389	Nep. 509.	Add. 1701 do.	Nep.	Cor.	12 × 2
89	1389	Sam. 1445.	Peterson <sup>5</sup> , No. 304.	W. Ind.	Cor.	34½ × 1½
90	1392	Nep. 512.	Add. 1108, Bendall.	Nep.	Cor.	13 × 2
91	1395	Sam. 1451.	Peterson <sup>5</sup> , No. 223.	W. Ind.	Cor.	14 × 1½
92	1398	Sam. 1454.	Peterson <sup>5</sup> , No. 48.	W. Ind.	Cor.	38 × 2
93	1400	Sam. 1456.	do. No. 28.	W. Ind.	Cor.	25 × 1½
94	1412	Nep. 532.	Add. 1649, Bendall.	Nep.	Cor.	12½ × 2
95	1412	Nep. 532.	Add. 1691 (iv), Bendall.	Nep.	Cor.	12 × 2
96	1425	Nep. 545.	Add. 1661 do.	Nep.	Cor.	18 × 2
97	1427	Nep. 547.	Add. 1580 do.	Nep.	Cor.	10 × 2
98	1429	Nep. 549.	Add. 1708 do.	Nep.	Cor.	11½ × 2
99	1440	Nep. 560.	Add. 1691, (iii) do.	Nep.	Cor.	12 × 2
100	1457	Nep. 577.	Add. 1708, (i) do.	Nep.	Cor.	12 × 2
101	1460	Laks. 355.	Notices, No. 1889.	Bih.	Cor.	12 × 1½
102	1463	Nep. 583.	Add. 1697 (iv), Bendall.	Nep.	Cor.	12 × 2
103	1468	Laks. 363.	Notices, No. 1913.	Bih.	Cor.	13 × 2

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
104	1495	Çak. 1417.	Notices, No. 1974.	Beng.	Cor.	10 × 2
105	1518	Çak. 1440.	do. No. 1070.	Beng.	Cor.	14 × 2½
106	1526	Lakş. 421.	do. No. 1963.	Bih.	Cor.	11 × 2
107	1529	Lakş. 424.	do. No. 2390.	Bih.	Cor.	16 × 2
108	1535	Çak. 1457.	do. No. 1978.	Beng.	Cor.	15 × 1½
109	1536	Lakş. 431.	do. No. 1967.	Bih.	Cor.	11 × 2
110	1540	Lakş. 435.	do. No. 1907.	Bih.	Cor.	11 × 1½
111	1556	Çak. 1478.	do. No. 2129.	Beng.	Cor.	10 × 2
112	1564	Lakş. 459.	do. No. 1909.	Bih.	Cor.	12 × 1½
113	1571	Çak. 1493.	do. No. 2172.	N. Beng.	Cor.	12 × 2
114	1576	Nep. 596.	Add. 1355, Bendall.	Nep.	Cor.	9½ × 2
115	1607	Lakş. 502.	Notices, No. 1879.	Bih.	Cor.	11 × 2
116	1609	Lakş. 504.	do. No. 1922.	Bih.	Cor.	12 × 2
117	1617	Lakş. 512.	do. No. 2405.	Bih.	Cor.	17 × 2
118	1618	Çak. 1540.	do. No. 2749.	Beng.	Bor.	12 × 1½
119	1619	Nep. 739.	Add. 1662, Bendall.	Nep.	Cor.	12 × 2
120	1622	Çak. 1544.	Notices, No. 2252.	Bih.	Cor.	14 × 2½
121	1624 1610	Çak. 1546. Lakş. 505.	do. No. 1992.	Bih.	Cor.	11 × 2
122	1627	Lakş. 522.	do. No. 2364.	Bih.	Cor.	14 × 1½
123	1629	Çak. 1551.	do. No. 3382.	Beng.	Cor.	10 × 2
124	1629	Çak. 1551.	do. No. 2000.	Bih.	Cor.	10 × 2
125	1643	Lakş. 538.	do. No. 2399.	Bih.	Cor.	16 × 1½
126	1660	Lakş. 555.	do. No. 1910.	Bih.	Cor.	14 × 2
127	1673	Lakş. 568.	do. No. 1968.	Bih.	Cor.	12 × 1½
128	1678	Çak. 1600.	do. No. 2126.	Beng.	Bor.	10 × 1½
129	1680	Çak. 1602.	do. No. 2759.	Beng.	Cor.	18 × 2
130	1687	Çak. 1609.	do. No. 1645.	W. Beng.	Bor.	19 × 1½
131	1688	Çak. 1610.	do. No. 1642.	W. Beng.	Bor.	19 × 1½

No.	A.D.	Date.	Reference.	Loc.	Mat.	Measure.
132	1689	Lakṣ. 584.	Notices, No. 1987.	Bih.	Cor.	12 × 2½
133	1701	Çak. 1623.	do. No. 1643.	W. Beng.	Bor.	14 × 1½
134	1727	Çak. 1649.	do. No. 2370.	Bih.	Cor.	22 × 2
135	1732	Çak. 1654.	do. No. 2917.	W. Beng.	Cor.	22 × 2
136	1734	Çak. 1656.	do. No. 2965.	W. Beng.	Bor.	11 × 1½
137	1739	Çak. 1661.	do. No. 1845.	Bih.	Cor.	15½ × 2
138	1755	Çak. 1677.	do. No. 2068.	N. Beng.	Cor.	40 × 2
139	1785	Çak. 1707.	do. No. 2069.	N. Beng.	Cor.	19 × 2
140	1804	Çak. 1726.	do. No. 1129.	Beng.	Bor.	3 or 4 lines
141 <sup>8</sup>	1836	Lakṣ. 731.	do. No. 1764.	Bih.	Bor.	11 × 1

In Table III, I have included none but such palm-leaf MSS., of which exact dates and measurements have been recorded. On the other hand, I have included all manuscripts, satisfying those two conditions, records of which were accessible to me: in fact, Table III. so far as I know, practically includes all such palm-leaf MSS., of which any record exists at all. I do not think it likely that any appreciable number of dated and measured manuscripts have been omitted. Those entered in Table III belong to the collections, noticed in Bendall's Catalogue of Cambridge MSS., Dr. Mitra's Notices of Sanskrit MSS., and Peterson's and Kielhorn's Reports on the Search for Sanskrit MSS. in the Bombay Presidency.<sup>9</sup>

As I have not actually seen and examined any of the manuscripts entered in Table III, the only test for determining their material are their measurements, especially those of their width. Now there are

<sup>8</sup> The description of this manuscript in the "Notices" is wrong. It is said to be dated "L. S. 431 = A.D. 1537," but at the same time it is described as "fresh" in appearance. The fact is, the date which is in numeral words has been wrongly read. *Ambudhi* means "seven"; and the date is Lakṣ. 731 = A.D. 1836. Unfortunately the manuscript is missing from the Calcutta collection; I have not been able to see it. I may here note that though in the older usage "ocean" signifies "four," in the more modern and in the present usage it means "seven." The *Çabda-kalpa-druma* gives both meanings.

<sup>9</sup> "Peterson<sup>8</sup>" and "Peterson<sup>5</sup>" in the References of Table III mean Professor Peterson's Third Report, 1884-86 (Extra Number in the Journal, Bombay Branch of the Royal Asiatic Society), and his Fifth Report, 1892-95, respectively. "Kielhorn" means Professor Kielhorn's Report for 1880-81.

in the list of Table III, 127 manuscripts, dating before 1675 A.D. Of these 127 manuscripts, 104 measure  $1\frac{1}{2}$  inches or upwards in width. All these must be written on Corypha leaves; for I have already shown that no Borassus leaf admits of that width. Practically the same remark applies to No. 36, which measures  $1\frac{1}{2}$  inches. There remain 22 manuscripts, measuring less than  $1\frac{1}{2}$  inches in width. Of these, 18 have a width of  $1\frac{1}{3}$  inches.<sup>10</sup> There is very little probability of any of them being a Corypha manuscript: in fact, in the case of No. 57, the fact that it is written on Corypha leaves has been verified for me by Professor Cowell; and as to 6 others, viz., Nos. 101, 110, 112, 122, 125 and 127, which are Bihār manuscripts, I shall show presently that in Bihār none but Corypha leaves were used down to a far more recent date than 1675 A.D. Of the remaining 4 manuscripts, No. 89, which is  $1\frac{1}{3}$  inches wide, cannot be Borassus, because of its length of  $34\frac{1}{2}$  inches; nor are Nos. 5, 8 and 10, which are  $1\frac{1}{4}$  and 1 inches wide respectively, likely to be Borassus, on account of their great age: that exceptionally Corypha manuscripts of such very small width are met with, I have already shown (see Nos. 35 and 55 in Table I, and No. 5 in Table II).

It thus appears that (with the exception of one manuscript, No. 118, presently to be referred to) all the manuscripts dating before 1675 A.D. are written on Corypha leaves,—a result which exactly agrees with that obtained from Table I. It is a striking fact that no dated and measured manuscript which can indubitably be proved to be written on Borassus leaves has as yet come to light, dating from before 1675 A.D., or at least (to be quite exact, with a view to the two exceptional cases of No. 60 in Table I, and No. 118 in Table III), dating from before the end of the 16th century. If Borassus manuscripts did exist, it is more than strange that not one of them should have been discovered: it is equally improbable that they—all and every one—should have perished. The only reasonable conclusion, from the facts presented, is that Borassus leaves were not used at all for book-writing in Northern India before the end of the 16th century, nor used generally before about 1675 A.D.

The exceptional case of No. 118 in Table III, dated 1618 A.D., is noteworthy. It stands, quite by itself among the surrounding Corypha manuscripts. For the next Borassus MS. we have to go down to No. 128, and the year 1678 A.D. It is also a South-Bengali manuscript. Its case agrees in every way with that of No. 60 in Table I, which has already been referred to. It must be added, however, that it is by no means certain that No. 118 is really a Borassus manuscript. Judged by

<sup>10</sup> These are Nos. 7, 9, 21, 25, 26, 30, 37, 41, 57, 82, 91, 93, 101, 110, 112, 122, 125, 127.



its measurements it might very well be a *Corypha* manuscript. But the probability perhaps is the other way, and I have accordingly treated it so.

This leads me to the next point. Table I shows that the use of *Borassus* leaves for book-writing was, and still is, limited to the Eastern portion of Northern India, *i.e.*, to Bengal, Bihār and Orissa. In the rest of Northern India (including Nepal, and "Western India" north of Bombay), *Borassus* has never been used for that purpose: there none but *Corypha* leaves were used at all; but as I shall show further on, the use of palm-leaves for book-writing died out there as early as the middle of the 15th century on the west-coast, and in the interior even some centuries earlier. At the time when the use of *Borassus* came in in the eastern provinces of Northern India, *viz.*, in the 17th century, the use of paper had in its central and western provinces long superseded that of palm-leaves.

Even with regard to Eastern India, a striking difference shows itself between the three provinces composing it. In Bengal the use of the *Borassus* leaf makes its first appearance in a sporadic way, at the end of the 16th century, and we find it fully established a century later, from about 1675 A.D. On the contrary, in Bihār the exclusive use of *Corypha* leaves continues down to the middle of the 18th century, while in Orissa *Corypha* leaves appear to have never been used at all.

To illustrate these conclusions I have prepared the following three Tables of Bengal, Bihār and Orissa palm-leaf manuscripts respectively.

TABLE IV. BENGAL PALM-LEAF MSS.

No.	A. D.	Date.	Reference.	Measures.	Material.
1	1360	Sam. 1416.	Table III, No. 82.	10 × 1½	Cor.
2	1386	Sam. 1442.	Table I, No. 45.	11 × 2	Cor.
3	1405	Çak. 1417.	Table III, No. 104.	10 × 2	Cor.
4	1514	Çak. 1486.	Table I, No. 53.	14½ × 1½	Cor.
5	1518	Çak. 1440.	Table III, No. 105.	14 × 2½	Cor.
6	1531	Çak. 1453.	Table I, No. 54.	13½ × 2	Cor.
7	1535	Çak. 1457.	Table III, No. 108.	15 × 1½	Cor.
8	1553	Çak. 1475.	Table I, No. 55.	1½	Cor.
9	1556	Çak. 1478.	Table III, No. 111.	10 × 2	Cor.
10	1571	Çak. 1493.	do. No. 112.	12 × 2	Cor.

No.	A.D.	Date.	Reference.	Measure.	Material.
11	1572	Çak. 1494.	Table I, No. 57.	$12\frac{1}{2} \times 1\frac{1}{2}$	Cor.
12	1587	Çak. 1509.	do. No. 60.	$12 \times \begin{cases} 1\frac{1}{2} \\ 1\frac{1}{2} \end{cases}$	Cor. Bor.
13	1594	Çak. 1516.	do. No. 60.	$12 \times 1\frac{1}{2}$	Bor.
14	1618	Çak. 1540.	Table III, No. 118.	$12 \times 1\frac{1}{2}$	Bor.
15	1629	Çak. 1551.	do. No. 122.	$10 \times 2$	Cor.
16	1675	Çak. 1597.	Table I, No. 70.	$1\frac{1}{2}$	Bor.
17	1677	Çak. 1599.	do. No. 71.	$1\frac{1}{2}$	Bor.
18	1678	Çak. 1600.	Table III, No. 128.	$10 \times 1\frac{1}{2}$	Bor.
19	1678	Çak. 1600.	Table I, No. 72.	$15\frac{1}{2} \times 2$	Cor.
20	1680	Çak. 1602.	Table III, No. 129.	$18 \times 2$	Cor.
21	1687	Çak. 1609.	do. No. 130.	$19 \times 1\frac{1}{2}$	Bor.
22	1687	Çak. 1609.	Table I, No. 76.	$11 > 1\frac{1}{2}$	Bor.
23	1688	Çak. 1610.	do. No. 77.	$20 \times 1\frac{1}{2}-1$	Bor.
24	1688	Çak. 1610.	Table III, No. 131.	$19 \times 1\frac{1}{2}$	Bor.
25	1689	Çak. 1611.	Table I, No. 78.	$14 \times 1\frac{1}{2}$	Bor.
26	1701	Çak. 1623.	Table III, No. 134.	$14 \times 1\frac{1}{2}$	Bor.
27	1721	Çak. 1643.	Table I, No. 82.	$2\frac{1}{2}$	Cor.
28	1732	Çak. 1654.	Table III, No. 136.	$22 \times 2$	Cor.
29	1734	Çak. 1656.	do. No. 137.	$11 \times 1\frac{1}{2}$	Bor.
30 <sup>11</sup>	1755	Çak. 1677.	do. No. 138.	$40 \times 2$	Cor.
31	1785	Çak. 1707.	do. No. 139.	$19 \times 2$	Cor.
32	1804	Çak. 1726.	do. No. 140.	3 or 4 ll., $1\frac{1}{2}$	Bor.
33	1815	Çak. 1737.	Table I, No. 87.	$14\frac{1}{2} \times 1\frac{1}{2}-1$	Bor.

It will be seen from Table IV, that up to 1587 A.D. Corypha leaves were in exclusive use in Bengal. In that year the first trace of the use of Borassus leaves makes its appearance. In 1594 there is the

<sup>11</sup> It will be noticed that the length of this manuscript (40 inches) is out of all proportion to that of all other Bengal manuscripts. I am, therefore, disposed to suspect a misprint in its record in "Notices," No. 2068.

first manuscript wholly written on *Borassus* leaves; another follows in 1618 A.D. Then comes a long interval of 57 years, up to 1675 A.D., in which there is one *Corypha* manuscript, in 1629 A.D. But from 1675, when there are numerous manuscripts recorded at very short intervals, the use of *Borassus* shows itself dominant. Among 18 manuscripts, between 1675 and 1815 A.D., there are 12 *Borassus* and only 6 *Corypha* ones; that is  $\frac{2}{3}$  of the whole are *Borassus* manuscripts.

The oldest known Bengal palm-leaf manuscript is referable to the year 1360 A.D. Another described in "Notices," No. 1977, was thought by the late Rāja R. L. Mitra to be older, being supposed to be dated in *Lakṣ.* 102=1207 A.D. It is a *Corypha* MS., measuring  $13\frac{1}{2} \times 2\frac{1}{4}$ , and is certainly very old, but its date, if any, is not decipherable, and on palæographic grounds it is more likely to belong to the end of the 14th century.

TABLE V. BIHĀR PALM-LEAF MSS.

No.	A. D.	Date.	Reference.	Measure.	Material.
1	1020	5 Mahipāla.	Table I, No. 8.	$21 \times 2\frac{1}{2}$	Cor.
2	1054	14 Nayapāla.	Table III, No. 2.	$22 \times 2$	Cor.
3	1120	15 Rāmapāla.	Table I, No. 16.	$22 \times 2\frac{1}{2}$	Cor.
4	1165	4 Gōvindapāla.	do. No. 21.	$22\frac{1}{2} \times 2\frac{1}{2}$	Cor.
5	1185	24 do.	do. No. 25.	$11\frac{1}{2} \times 2$	Cor.
6	1199	38 do.	do. No. 27.	$11\frac{1}{2} \times 2\frac{1}{2}$	Cor.
7	1319	<i>Lakṣ.</i> 214.	do. No. 37.	$15\frac{1}{2} \times 1\frac{1}{2}$	Cor.
8	1446	<i>Sam.</i> 1503.	do. No. 47.	$13\frac{1}{2} \times 2\frac{1}{2}$	Cor.
9	1450	<i>Lakṣ.</i> 345.	do. No. 48.	$13 \times 1\frac{1}{2}$	Cor.
10	1460	<i>Lakṣ.</i> 355.	Table III, No. 101.	$12 \times 1\frac{1}{2}$	Cor.
11	1467	<i>Lakṣ.</i> 362.	Table I, No. 49.	$13 \times 2$	Cor.
12	1468	<i>Lakṣ.</i> 363.	Table III, No. 103.	$13 \times 2$	Cor.
13	1479	<i>Lakṣ.</i> 374.	Table I, No. 50.	$11\frac{1}{2} \times 2$	Cor.
14	1504	<i>Lakṣ.</i> 399.	do. No. 51.	$14\frac{1}{2} \times 2\frac{1}{2}$	Cor.
15	1513	<i>Lakṣ.</i> 406.	do. No. 52.	$13\frac{1}{2} \times 1\frac{1}{2}$	Cor.
16	1526	<i>Lakṣ.</i> 421.	Table III, No. 106.	$11 \times 2$	Cor.
17	1529	<i>Lakṣ.</i> 424.	do. No. 107.	$16 \times 2$	Cor.

No.	A.D.	Date.	Reference.	Measure.	Material.
18	1536	Lakṣ. 431.	Table III, No. 109.	11 × 2	Cor.
19	1540	Lakṣ. 435.	do. No. 110.	11 × 1½	Cor.
20	1557	Lakṣ. 452.	Table I, No. 56.	13½ × 2	Cor.
21	1564	Lakṣ. 459.	Table III, No. 112.	12 × 1½	Cor.
22	1575	Lakṣ. 470.	Table I, No. 58.	13½ × 2½	Cor.
23	1607	Lakṣ. 502.	Table III, No. 115.	11 × 2	Cor.
24	1608	Lakṣ. 503.	Table I, No. 62.	13½ × 1½	Cor.
25	1609	Lakṣ. 504.	do. No. 63.	13½ × 2	Cor.
26	1609	Lakṣ. 504.	Table III, No. 116.	12 × 2	Cor.
27	1616	Lakṣ. 511.	Table I, No. 64.	14½ × 1½	Cor.
28	1617	Lakṣ. 512.	Table III, No. 117.	17 × 2	Cor.
29	1622	Ḷak. 1544.	do. No. 120.	14 × 2½	Cor.
30	1624 1610	Ḷak. 1546 Lakṣ. 505.	do. No. 121.	11 × 2	Cor.
31	1627	Lakṣ. 522.	do. No. 122.	14 × 1½	Cor.
32	1629	Ḷak. 1551.	do. No. 124.	10 × 2	Cor.
33	1633	Ḷak. 1555.	Table I, No. 65.	12 × 1½	Cor.
34	1643	Lakṣ. 538.	Table III, No. 125.	16 × 1½	Cor.
35	1647	Ḷak. 1569.	Table I, No. 66.	11½ × 2	Cor.
36	1660	Lakṣ. 555.	Table III, No. 126.	14 × 2	Cor.
37	1661	Lakṣ. 556.	Table I, No. 67.	12½ × 1½	Cor.
38	1668	Ḷak. 1590.	do. No. 68.	7½ × 1½	Cor.
39	1669 1660	Ḷak. 1591 Lakṣ. 555.	do. No. 69.	7 × 1½	Cor.
40	1673	Lakṣ. 568.	Table III, No. 127.	12 × 1½	Cor.
41	1680	Ḷak. 1602.	Table I, No. 73.	14 × 1½	Cor.
42	1689	Lakṣ. 584.	Table III, No. 132.	12 × 2½	Cor.
43	1727	Ḷak. 1649.	do. No. 134.	22 × 2	Cor.
44	1739	Ḷak. 1661.	do. No. 137.	15½ × 2	Cor.
45	1836	Lakṣ. 731.	do. No. 141.	11 × 1	Bor.

Among the 45 manuscripts listed in this Table, there are 35 which, as their width shows, are undoubtedly written on *Corypha* leaves. There are only eight MSS. (Nos. 9, 10, 19, 21, 31, 34, 37 and 40) which, by their width of  $1\frac{1}{2}$  inches, might be written on *Borassus* leaves. But their age, as well as their isolated position among *Corypha* manuscripts, renders it certain that they are also *Corypha* manuscripts. Indeed, as a matter of fact, Nos. 9 and 37, which I have myself inspected, are *Corypha* manuscripts. I may add that down to 1739 A.D. (No. 44) I have not found, among all the Bihār MSS. that I have examined and measured, a single manuscript written on *Borassus* leaves. So far, therefore, as evidence, at present available, goes, it points to the fact that, down to the middle of the 18th century, **Corypha leaves were in exclusive use in Bihar for book-writing.** About that time, perhaps, the use of *Borassus* leaves may have been introduced from Bengal; for No. 45, of 1836 A.D., is evidently a *Borassus* manuscript. Any how, in the present day, as I learn from special enquiries made by me, both kinds of palm-leaf are in use in Bihār, though, for book-writing at least, paper has nearly entirely superseded palm-leaf, so that it is very difficult now-a-days to obtain a quite modern palm-leaf manuscript. In fact, in spite of persistent endeavours, I have failed to obtain for personal inspection a single Bihār palm-leaf manuscript of the 18th and 19th centuries. This remark, regarding the supersession of palm-leaf by paper, also applies to Bengal, but not to Orissa.

With regard to Orissa I am in a somewhat unsatisfactory position. Palm-leaf manuscripts, written in Oriya, are very uncommon in Calcutta, and the majority of those one meets with are not dated. Moreover the few manuscripts which bear some date are not dated in any era, but merely in the regnal years of certain kings. I have been able to examine the following seven manuscripts:—

TABLE VI.<sup>18</sup> ORISSA PALM-LEAF MSS.

No.	A.D.	Date.	Reference.	Measures.	Mat.
1	1660-92	Some year of Mukunda	Govt. Ind.	$1\frac{5}{8}$	Bor.
2	1683	24th do. ...	do. "	$15 \times 1\frac{1}{2}$	Bor.
3	1683	24th do. ...	do.	$1\frac{1}{4}$	Bor.
4	1690	31st do. ...	No. 2837 in Notices.	$16 \times 1\frac{1}{4}$	Bor.
5	1708	17th of Divya Simha ...	Govt. Ind.	$14\frac{9}{16} \times 1\frac{1}{2}$	Bor.
6	1752	10th of Kāçari ...	do.	$14\frac{3}{4} \times 1\frac{1}{2}$	Bor.
7	1766	24th of do. ...	do.	$15 \times 1\frac{1}{2}$	Bor.

<sup>18</sup> On the chronology of the kings of Orissa, see Prinsep's *Useful Tables*, p. 267 (in Vol. II of his *Indian Antiquities*, ed. Thomas), also Hunter's *Orissa* and J. I. 16

I have also examined seven other manuscripts which are undated. Their width varied from 1 to  $1\frac{1}{2}$  inches, and their number of lines from 3 to 6. They were made of *Borassus flab.* Their general appearance indicates them as being of the same period as the dated ones.

I have not met with any Oriya palm-leaf manuscript of an earlier date than the 24th year of Mukunda Dēva, or A.D. 1683, though No. 1 may go back to 1660. So far as this evidence goes, it shows that Oriya palm-leaf manuscripts are not older than the second half of the 17th century, and are invariably written on *Borassus* leaves. The evidence, however, is not complete. It seems to be certain that the Oriyā characters were not employed in Orissa before the 15th century A.D. The earliest epigraphical record in Oriyā characters is an inscription, dated 1436 A.D., of Kapilēṣvara Dēva. The earlier inscriptions of the 13th and 14th centuries are in a species of early Bengali characters.<sup>18</sup> It is not impossible therefore, that manuscripts may have been written in Oriyā characters as early as the 15th century A.D. Possibly among the undated manuscripts some may go back to such an early date; and it is also possible that dated manuscripts of that early period may yet come to light. In the latter case it is probable that they will be found to be *Borassus* manuscripts; for hitherto not a single manuscript written in Oriyā characters is known to exist which is written on *Corypha* leaves. At present, however, there is a gap of 200 or 250 years (about 1436–1660 A.D.) in the evidence. On the whole, the probability is that the case of Orissa is much the same as that of Bengal. If *Corypha* leaves were ever used in Orissa at all, their use must have gone out of fashion, as it did in Bengal, in the course of the 16th century. At present, **the available evidence**

elsewhere. The exact periods of the several reigns are only approximately known. There were three Mukundas and two Divya Simhas. The former reigned 17, 32, and 19 years respectively; accordingly it must be Mukunda II who is referred to in Table VI, and who reigned, approximately, from 1660 to 1692 A.D. The two Divya Simhas reigned 28 and 18 years respectively; probably it is Divya Simha I who is here intended, and who reigned from 1692–1720 A.D. Kēçari Dēva (in Prinsep, Bir Kishore Deo) reigned from 1743–1780 A.D. In the manuscripts the reigns of these kings are quoted in *aykas*. On the method of converting these *aykas* into regnal years, see Bābū Mon Mohan Chakravarti's explanation in *Journal, A.S.B.* vol. LXII, (1893), p. 89. The number one and all numbers ending with zero (except 10) or with 6 are omitted. Hence the 29th *ayka* of Mukunda is equal to his 24th year; i.e., 5 *aykas* (1, 6, 16, 20, 26) are omitted; and so forth. The *aykas* of Table VI are: 38 (No. 4), 29 (Nos. 2, 3 and 7), 21 (No. 5), 12 (No. 6). No. 1 simply refers to the reign of Mukunda.

<sup>18</sup> See *Journal, A.S.B.* Vol. LXII (1893), p. 88, 89. Also *ibidem*, Vol. LXIV (1895) and Vol. LXV (1896).

is dead against the use of *Corypha* leaves in Orissa. Not a single *Corypha* manuscript in Oriyā characters has as yet been discovered.

Let us now turn to Western India. Here we have the careful catalogues prepared by Professors Kielhorn, Peterson and Bhandarkar. In his Report for 1880-81, Prof. Kielhorn describes 77 palm-leaf MSS. from Pātān. Prof. Peterson in his 3rd Report for 1885-86, describes 157 palm-leaf MSS. from Cambay (Nos. 181-338), and in his 5th Report for 1892-95 he describes 93 palm-leaf MSS. from Pātān. Measurements, however, are only given of 69, 147 and 62 manuscripts respectively of the three sets. The total of measured manuscripts accordingly is 278. Among these there are :

(1) MSS. measuring $1\frac{3}{4}$ inches and more,	230
(2) MSS.        ,, $1\frac{1}{2}$ inches	38
(3) MSS.        ,,        less than $1\frac{1}{2}$	10

This statement includes both kinds of manuscripts, undated as well as dated ones, and, therefore, supplements the information given in Table III.

The first-placed manuscripts, of course, as shown by their width, must be *Corypha* ones; so also, are in all probability, the 38 manuscripts of the width of  $1\frac{1}{2}$  inches. More doubtful might seem the case of those ten which measure less than  $1\frac{1}{2}$  inches. Among these there are 8 manuscripts which are said to measure only  $1\frac{3}{8}$ ,  $1\frac{1}{3}$ , or  $1\frac{1}{4}$  inches, and two manuscripts which are said even to be only one inch wide.<sup>14</sup> Four of these 10 manuscripts, being dated, will be found included in Table III; *viz.*, Nos. 10 (1" wide), 5 and 8 ( $1\frac{1}{4}$ " ), and 89 ( $1\frac{1}{3}$ " ); and in connection with that Table it has been shown what little probability there is that any of these 10 manuscripts should be *Borassus* ones. As a matter of fact (I may add here), I have found by ocular examination of Kielhorn's No. 34 (or No. 35 in Table I) that among its leaves there are some which are only  $1\frac{1}{4}$  inches wide, but which still are *Corypha* leaves: which circumstance shows that extreme narrowness of the leaves need not preclude their being *Corypha*. It may, therefore, be taken for certain that in Western India none but *Corypha* leaves were ever used for book-writing.

We will now turn to the paper manuscripts. For Eastern India (Bengal, Behar and Orissa) the "Notices of Sanskrit Manuscripts" afford a fair statistical text. I have classified all the dated paper MSS. which are enumerated in volumes I to X, according to centuries, down to 1850, in the subjoined Table VII, in which I have added similar information,

<sup>14</sup> These are Peterson's Nos. 7, 63 (both one inch), Peterson's No. 13, Kielhorn No. 40, Peterson's Nos. 50, 66 (all four,  $1\frac{1}{4}$ " ); Peterson's Nos. 304, 305, 308 (all,  $1\frac{1}{4}$ " ); Peterson's No. 216 ( $1\frac{3}{8}$ " ).

for Western India, gathered from the Reports of Professors Bhandarkar, Kielhorn and Peterson.<sup>16</sup> For my present statistical purpose these Reports, unfortunately, are not so well fitted as the "Notices;" still such as they are, their evidence distinctly tends in the same direction. A considerable portion of the manuscripts described in the "Notices" belong to the North-West Provinces and Oudh, which form the central portion of Northern India. Accordingly the column for the "Notices" is divided into East and Centre.

TABLE VII.

PERIODS.	NOTICES.		BHANDARKAR.	KIELHORN.	PETERSON.				
	East.		Centre.	West.					
	Palm-leaf.	Paper.	Paper.	Palm-leaf.	Paper.	Palm-leaf.	Paper.	Palm-leaf.	Paper.
(1) 1050-1150				7		6		14	
(2) 1150-1250			1	14		5		68	
(3) 1250-1350			1	13	1	6		46	
(4) 1350-1400	2	1	1	3	2		2	4	10
(5) 1400-1450		1	4		5	2	9	1	27
(6) 1450-1550	12	7	8		20		47		61
(7) 1550-1650	16	14	40		61		53		162
(8) 1650-1750	18	56	70		93		65		240
(9) 1750-1850	5	107	201		96		48		369

The general drift of this evidence is to show that from the end of the 13th and the beginning of the 14th centuries paper began to

<sup>16</sup> These are Bhandarkar's Report for 1882-83; Kielhorn's Report for 1880-81, containing also a list of the collection in 1873-74; Peterson's Second Report for 1882-83 (being an Extra Number of the Journal of the Bombay Branch of the Royal Asiatic Society for 1883); his Third Report for 1884-86 (being another Extra Number for 1887); his Fifth Report, for 1892-95, and his Sixth Report, for 1895-98.



supersede palm-leaf as a material for writing books. The drop in the number of palm-leaf manuscripts between the third and fourth periods is very noticeable; and from the fourth period onwards there is a steady and marked rise in the number of paper manuscripts.

In Western India the supersession of palm-leaf was far more thorough than in Eastern India. **About the middle of the 15th century**,—so far as the evidence at present available goes,—**the use of palm-leaf entirely ceases in Western India.** The three latest palm-leaf manuscripts are dated, one in A.D. 1449 (Sam. 1505), and two in A.D. 1400 (Sam. 1456): see Kielhorn's Report, p. v, and Peterson's Fifth Report, p. 51. During the same period (1400-1449) we have 41 paper manuscripts. The earliest paper manuscript is dated A.D. 1320 (Sam. 1376): see Bhandarkar's Report, p. 51. Then follow 14 paper manuscripts, dated between A.D. 1360 and 1395. This total cessation of the use of palm-leaf at this period is nothing new: it has already been pointed out by Professor Bhandarkar in his Report, pp. 51 and 52.

**In Eastern India the use of palm-leaf continued more or less by the side of paper.** The Table shows a steady and marked rise in the number of paper manuscripts, while the number of palm-leaf manuscripts remains practically stationary, ending with a marked drop in the last period. This, of course, really implies a steady decrease in the use of palm-leaf, ending with a practically total cessation, in the present day.<sup>16</sup> In Orissa alone its use continuous to some extent. The two latest recorded palm-leaf manuscripts (both not on *Corypha*, but *Borassus* leaves) are dated A.D. 1815 (Çaka 1737; "Notices," No. 1607, Table I, No. 87) and A.D. 1836 (Lakṣ. 731, "Notices," No. 1764, Table III, No. 141). The earliest paper manuscript is dated A.D. 1354 (Sam. 1410), and is a Behar (Maithili) manuscript, No. 1999 in the "Notices." The oldest Bengal paper manuscript is dated A.D. 1404 (Çaka 1326), being No. 2082 in the "Notices." These are two exceptional cases: **the real use of paper in Eastern India only commences about A.D. 1450, that is about one century later than in Western India.**

But the earliest paper manuscript of all, examined by me, is one in the Sanskrit College in Calcutta. It is No. 582 in Volume I of its Library Catalogue, and is dated A.D. 1231 (Sam. 1288).<sup>17</sup> The oldest

<sup>16</sup> Exceptionally, and for a very limited class of certain religious books, palm-leaf is said to be still used in Bengal.

<sup>17</sup> The Calcutta Sanskrit College, in its Library Catalogue, professes to possess extraordinarily old paper manuscripts. No. 553 in Vol. I is said to be dated in 1017 A.D. or Sam. 1073; No. 371 in 1059 A.D. or Sam. 1115, No. 122 in Vol. II. in 1178 A.D. or Sam. 1234; No. 582 in Vol. I. in 1212 A.D. or Sam.

paper manuscript of all, mentioned in the "Notices" is No. 2043. It is dated A.D. 1343 (Sam. 1399), and has no string-hole, but in its place a small read disk, about  $\frac{3}{8}$ " diameter. These two earliest paper manuscripts are shown in Table VII in the column for "Notices," under the heading "Centre." They are both written in a distinctly Western type of Nāgarī, and must have been written somewhere in the North-West Provinces: they do not properly belong to Eastern India. Under the heading "Centre" are entered paper manuscripts written in Nāgarī (not in Bengali, neither in Maithili) characters. All these properly belong to the North-West Provinces or Oudh, *i.e.*, to the Central part of Northern India. It may be noticed that no palm-leaf manuscripts are recorded for this part of Northern India. This is a noteworthy fact, to which reference will be made subsequently.

To sum up the result of my enquiries into the use of palm-leaf as writing material, it appears that—

(1) Originally none but leaves of the *Corypha umbr.* palm were used throughout India. This state continued down to the 15th century.

(2) From the middle of the 15th century their use was discontinued in Western India, no other kind of palm-leaf replacing them.

(3) From the beginning of the 17th century they ceased to be used in Bengal and probably Orissa, the leaves of the *Borassus fl.* taking their place.

(4) In Behar their exclusive use continued down to the middle of the 18th century.

(5) The use of the *Borassus flab.* is comparatively modern, and it is, and was, nowhere current in Northern India, outside Bengal and Orissa.

(6) Paper began to come into use, in the Centre of Northern India, in Western India and in Eastern India about the middle respectively of the 13th, 14th and 15th centuries.

(7) In the Centre and West it entirely superseded, in the 15th century, the writing-material previously in use, that is, palm-leaf in the West and perhaps birch-bark in the Centre. In the East it maintained a finally successful rivalry until comparatively recent times.

1268; No. 529 in A.D. 1320 or Sam. 1376. I have examined all these manuscripts. They are all written in Nāgarī, and are North-Western manuscripts (not Bengali). No. 553 is as modern a manuscript as one can wish, and is dated Sam. 1873, or A.D. 1817! No. 371 is dated Sam. 1715 or A.D. 1659. No. 122 is dated Sam (*i.e.*, Bengali year, not Saṃvat) 1234, equal to A.D. 1826. No. 582 is doubly dated in Sam. 1288 (not 1268 as the Catalogue reads), and Çaka 1152, which is A.D. 1231 (*viz.*, 1288-57 and 1152+79); this is the only really old paper manuscript. No. 529 is not dated at all, the compiler of the Catalogue having mistaken some blurred Nāgarī akṣaras for numeral figures.

The *Corypha umbraculifera* being a South-Indian tree, it is clear that its leaves, prepared to serve as writing material, must have formed an article of trade from very early times, and been carried as merchandise over the whole of Northern India. The customers of it, of course, were almost wholly limited to the literary classes, who wrote and copied books, *i.e.*, to the learned in schools and monasteries, etc. Paper came in with the Muhammadans, in the 11th century. It only very slowly and gradually displaced the *Corypha* palm-leaf, the use of which had the sanction of age and religion among the conservative Indian literates: they looked with distrust upon the product of the Mlecchas. The paper-makers are still, as a rule, Muhammadans; and there exists no indigenous Sanskritic term for paper, the word universally used being *kāgaj* or *kāgad*.<sup>13</sup> With the 14th century, paper began to grow more widely into favour, and the import trade of *Corypha* leaves proportionately declined. With the beginning of the 17th century we find that paper has displaced the *Corypha* leaves throughout Northern India excepting Behar, and the trade with it had practically ceased. Palm-leaves were still occasionally wanted; and thus it came to pass (so it seems) that the people of Bengal and Orissa took to the use of the *Borassus flabellifer* which grew plentifully in their own country, because they could no more readily obtain suitable *Corypha* leaves in sufficient quantities. It is curious to observe that the literati of Behar were the most conservative in the retention of the use of the *Corypha* leaves; for their latest *Corypha* MS. is dated A.D. 1739 (No. 44 in Table V).

It would seem that the use of the leaves of the *Borassus* palm was introduced into Eastern India from the South. For its use in Southern India can be traced to a much earlier period. As Table II shows, the earliest recorded *Borassus* manuscript in Southern India may be referred to about 1550 A.D., and since that time *Borassus* is generally, though not exclusively, made use of, in Southern India, for book writing, *Corypha* also being used occasionally. The case of Southern India, however, I have not been able to thoroughly investigate. In Ceylon the use of *Corypha* leaves appears to be still predominant; in fact, for book writing, I am informed, it is still in exclusive use. The cause or causes that led to the *Borassus* growing into favour, and more or less displacing the time-honoured *Corypha* are obscure. It

<sup>13</sup> This is a Hindū corruption of the Persian *kāghaz* (کاغذ), which itself is a corruption of the Chinese *kog-az*, the name of their "paper made of the bark of the paper-mulberry tree." When the Arabs, in the 8th century, learned paper-making from the Chinese, they adopted the Chinese name for their own paper made of linen rags. See Professor Fr. Hirth's *Indische Studien*, p. 263, and Professor Karabaček's *Führer durch die Ausstellung der Papyrus Erzherzog Rainer*.

would be interesting to know them, and they would be worth investigation. Perhaps it may be found that the Borassus palm was introduced into India only at a comparatively recent period, and being a more useful tree than the Corypha, it was more frequently cultivated, and more extensively employed. Of the Borassus palm almost everything can be used: its fruits and buds are edible, its juice is made into liquor, its leaves can be used for domestic and literary purposes, its trunks are shaped into boats; and so forth. Of the Corypha palm neither the fruit is edible nor the juice potable. Being a far more useful tree, the Borassus would naturally soon become a greater favorite even with respect to such a matter as the leaves for writing purposes in which it is perhaps hardly superior to the Corypha. But it is difficult to suppose that the employment of the Borassus leaves as a material for writing can be separated by any long interval from the introduction of the Borassus palm into India. The tree could not well have existed long in India without its useful properties being discovered. If the use of its leaves for writing grew up in the 15th or 16th centuries, its introduction can hardly be placed much earlier than the 14th century.

There is a notice in Hiuen Tsiang's Travels (Beal, vol. ii, p. 255) of the existence of "a forest of Tāla trees" near Konkanapura in South-India. The exact site of that place is still a matter of dispute (see *Indian Antiquary*, XII, p. 115, XXIII, p. 28); but it must be somewhere in the Concan, which is the limit to which the Corypha umbr. grows freely in *cultivation* (though not *wild*). The pointed notice of the "forest of Talipat palms" is curious. It must have been a particular feature of that place, and must have been shown to Hiuen Tsiang as such. In the forest there was a Stūpa; and Hiuen Tsiang adds that "in all the countries of India the leaves of the Talipat palm are everywhere used for writing on." Here we seem to have a clear instance of a plantation of Corypha palms, on a large scale, for the purpose of growing leaves for inland use or for export. Writing was mainly carried on in Buddhist and other monasteries, and probably there were Corypha plantations connected with most of the larger monastic establishments in South India; only the Konkanapura plantation would seem to have been one on a particularly large scale.

There is a puzzling notice in Alberuni (Sachau, vol. i, p. 171). He says: "The Hindus have in the South of their country a slender tree like the date and cocoanut palms, bearing edible fruits, and leaves of the length of one yard, and as broad as three fingers, one put beside the other. They call these leaves *tārī*, and write on them. They bind a book of these leaves together by a cord on which they are arranged, the cord going through all the leaves by a hole in the middle of each."

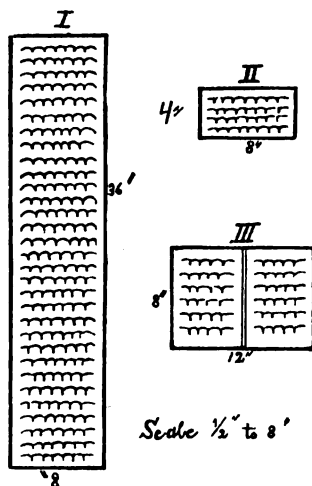
This description, with the exception of the remark about the edible fruit, only fits the *Corypha* palm. At the time of Alberuni (973–1043 A.D.) the *Borassus* palm, in all probability, did not exist in India. In any case, at his time its leaves were not used anywhere in India for writing books. He says the leaves measured one yard in length, and three fingers in breadth: that gives us a leaf measuring  $36 \times 2\frac{1}{2}$  inches, which, as I have shown, are nearly the maximum measurements of a *Corypha* leaf, but impossible for a *Borassus* leaf.<sup>19</sup> He also says that the leaves are called *tāri*. At the present day, the term *tāri* (ताड़ी) is used to denote palm-wine or “toddy,” which, of course, is made from the juice of the *Borassus* palm. I am not aware that the term is used anywhere for the prepared leaves of either the *Corypha* or the *Borassus*. These are called *Tālpāt* or *Tālipāt*, and that term is applied to the *Corypha* palm in South India, and has been adopted into the Botanical terminology. In Alberuni’s use of the term *tāri* for the leaves, there appears to be some misunderstanding. But a greater difficulty is his remark about the edible fruits, as Alberuni is generally a careful observer and reporter. Personally he can have had no acquaintance with the tree, as neither the *Corypha* nor the *Borassus* grows in the localities where he lived: he can only have reported what he was told. But as the *Borassus* palm is out of the question, he must either have made a slip, or the text of his work is handed down incorrectly. As immediately before he had mentioned a point of resemblance to the date and cocoanut palms, he probably now wanted to point out a point of difference, that the *Corypha* palm bore no edible fruits; he probably meant to say “a tree, slender like the date and cocoanut palms, but bearing no edible fruits.”

Alberuni proceeds to say: “In Central and Northern India people use the bark of the *tūz* tree. It is called *bhūrja*. They take a piece one yard long and as broad as the outstretched fingers of the hand, or somewhat less (about 8 inches) and prepare it in various ways. They oil and polish it so as to make it hard and smooth, and then they write on it. Their letters, and whatever else they have to write, they write on the bark of the *tūz* tree.” There can be no doubt that Alberuni is describing the bark of *Betula utilis*. Where he lived, the tree was probably a well-known object to him. The measurements of the strips of bark given by him are borne out by the *Kharōṣṭhī* birch-bark

<sup>19</sup> In the quoted passage it seems as if Alberuni were speaking of the size of the natural leaves of the palm. Obviously this is not correct; for the size of the segment of the natural leaf of either palm, whether *Corypha* or *Borassus*, is much greater. Possibly the translation may be at fault. Anyhow, Alberuni is speaking of the size of the prepared leaf.

manuscript of which portions are preserved in Paris and St. Petersburg,

and which may be as old as the 1st century A.D. The strips of bark on which this manuscript is written, measure about 8 inches (or 20 centimeter) in width and one yard, more or less, in length<sup>20</sup> (Woodcut, fig. 1). This seems to show that anciently the strips of bark were used in their full size, perhaps in the form of rolls, like Greek manuscripts of papyrus. Or their length was cut up into smaller pieces, of about 4 inches each. Such is the *Bakhshālī* MS., which measures about 7 by 4 inches. The latter probably belongs to the 10th or 11th century, i.e., about the time when Alberuni lived; and



he may have been thinking of manuscripts of this kind, when he wrote his observations. The writing was made to run parallel with the narrow side of the original strip, as seen in the published plates of the Paris and St. Petersburg MS. This custom was retained, even when the strips were cut up into smaller pieces, as in the *Bakhshālī* MS. (Woodcut, fig. 2). The latter approaches, in its general form, the typical Indian palm-leaf *pothī*. It consists of a large number of separate oblong leaves, with the writing running parallel with the longer side of the leaf; only the oblong is not so decidedly elongated as in the palm-leaf, and the string-holes are wanting. Still later, after Alberuni's time, the modern book form appears to have been introduced. The strips of bark, cut into smaller pieces of about 12 inches, were folded in the middle, making up a "form" of two leaves or four pages; and the writing was now made to run parallel with the narrow side of the page, so that, if the form is unfolded into the original sheet or strip, the

<sup>20</sup> The exact length is uncertain. M. Senart has measured one of the length of 4 feet (or 1 m. 23), but states that the strips evidently vary in length. See *Journal Asiatique*, 1898. See also Professor v. Oldenburg's Report in the Transactions of the Imperial Russian Academy, for 1897. Woodcut, fig. 3 shows the exact measurements of a *Çaradā* manuscript in my possession, about 250 years old.

writing is seen to be in two columns and running parallel with the longer side of the strip as shown in fig. 3 of the Woodcut.

A noteworthy point in Alberuni's statement is that it seems to assert that, in his time at least, the use of birch-bark was peculiar to Central and Northern India, while palm-leaf was peculiar to Southern India. At first sight this assertion does not seem to be borne out by the evidence set out in the earlier part of this paper. Hsien Tsiang also states explicitly that in his time (7th century) palm-leaf was used throughout India, and he travelled over the whole of India, and was in touch with the literary classes of India. All depends on the exact meaning of Alberuni's terms. That he cannot have included in his "Northern India" those portions which I have denoted Western and Eastern India is clear from the fact shown by my evidence that all the oldest manuscripts of those parts of Northern India, going back practically to the time of Alberuni himself, are of palm-leaf. There is no reason why birch-bark manuscripts should not have survived as well as palm-leaf manuscripts in the libraries of Pātān and Cambay, and elsewhere, if any birch-bark manuscripts had existed at all. That birch-bark manuscripts are quite capable of surviving for so long a time is proved by the Bower MS. Alberuni's "Northern India" must be limited to the Panjāb, Sindh, Rājputānā and Kashmir, and his "Central India" must mean the North-West Provinces and Oudh, or what I have called the "Centre" of Northern India. In fact, Alberuni's terms are bounded by about the 24th Lat. and 85th Long., and India below the 24th Lat. is what he designates "Southern India." Understood in this sense, his statement is probably quite correct. It is true the evidence available on the point is very scanty. The only three birch-bark manuscripts of any considerable age, which are known to have survived are (1) the Paris and St. Petersburg MSS., (2) the Bower MS., and (3) the Bakshālī MS. They all come originally from that portion of India which Alberuni includes in his "Northern India;" and—so far—they show that birch-bark was used there for book-writing. Nos. 1 and 2 are much older than Alberuni's time. No. 1 dates probably from the 1st or 2nd century A.D., the period of a still strong Greek influence, and its apparently roll-like form may be due to that influence. No. 2 dates from about 450 A.D., and is in the Indian Pōthī form, oblong, like the corypha leaf, with a string-hole.<sup>21</sup> It belongs to a period of a still strong Buddhist intercourse between what Alberuni calls "Southern India" and Central Asia. This may account for its distinctly Indian Pōthī form. No. 3 probably dates from about the

<sup>21</sup> The Bower MS. contains several distinct works, written on leaves of two distinct sizes,  $11\frac{1}{2} \times 2\frac{1}{4}$ " and  $9 \times 2$ ", but both imitating the Corypha leaf.

time of Alberuni himself. Its form is peculiar. It resembles the Indian *Pothī*, in consisting of separate leaves, not "bound" in a book, but tied together in a bundle: but it differs from the *Pothī* in not having any string-hole for the passage of the tying string. The string-hole was probably omitted as being too risky for the material. It also differs in its shape, being squarish ( $7 \times 4''$ ), and not so distinctly oblong as the common Indian *Pothī*, made with the long narrow palm-leaves. Now it is noteworthy that the two oldest paper manuscripts known to us point to their having been made in imitation of such a birch-bark prototype as the Bakhshālī MS. The oldest paper manuscript, dated 1281 A.D. (*supra*, p. 121) has exactly the same squarish shape; it measures  $6 \times 4$  inches. The next oldest paper manuscript, dated A.D. 1343, is rather more oblong, measuring  $12\frac{1}{2} \times 5$  inches, but it has no string-hole. Both these manuscripts come from that part of India which Alberuni calls "Central India as above explained." It seems permissible to conclude that when paper came into use, its leaves were cut and treated in imitation of birch-bark book-leaves in those parts of India where birch-bark was the common writing material, and that it was cut and treated in imitation of palm-leaf, wherever the latter material was used for book-writing. In this connection it is worth noting that no old palm-leaf manuscripts are known to come from Alberuni's "Northern and Central India," though, considering the scanty survival of birch-bark manuscripts, too great importance may not be attached to this point.<sup>23</sup> Regarding this point of survival, it may be noted that it applies equally to all kinds of manuscripts, whether of paper or of birch-bark or of palm-leaf. This circumstance shows that the cause of the non-survival is not to be sought in the climatic conditions of Alberuni's "Northern and Central India." These need not have prevented a reasonable amount of survival. The cause is probably rather to be sought in the political and religious troubles which so frequently convulsed those portions of India. During the Muhammadan conquest, for example, large destructions of Hindu literary works are reported to have taken place.

In this connection there is another interesting point to be noted. The Bower MS., which is written on birch-bark and is certainly as

<sup>23</sup> There are a few very old palm-leaf manuscripts, but they all come from Western India; at least there is no reason to assume any other place of origin for them. They are enumerated in Table I, Nos. 1-5. No. 5 is dated by Mr. Bendall in the Harṣa era, and this might seem to suggest the "Centre" of Northern India as its place of origin. But, in the first place, the date may be, and as I believe is, more probably, referable to the Gupta era, in which case the date of the manuscript is A.D. 571-2. In the second place, considering the wide extension of the Harṣa empire, even a Harṣa date is not incompatible with a Western Indian origin which on general grounds is far more probable.



early as the middle of the 5th century, is fashioned exactly like the typical Indian Corypha palm-leaf manuscript. It consists of separate leaves, provided with a string-hole, and these leaves measure from 2 to  $2\frac{1}{2}$  inches in width, which is the width of the Corypha leaf. But further, all the oldest paper manuscripts from Kuchar imitate the Indian Corypha leaf manuscripts, as may be seen from the specimens of the Weber MSS. and the Macartney MSS. which I have published. They all consist of separate, elongated oblong leaves, from  $2\frac{1}{4}$  to  $2\frac{3}{4}$  inches wide, with a string-hole, and with the writing running parallel with the longer side of the leaf. Everything points to the inscribed Corypha leaf as the model, not even to a Borassus leaf. The Bower MS. and those Weber and Macartney MSS. which are written in Indian Gupta characters must have been written by native Indians migrated to Kuchar, while the other Weber and Macartney MSS. written in the Central Asian modification of the Indian Gupta were probably written by native Kuchāris.<sup>23</sup> Why should the people of Northern India and of Central Asia have gone to the trouble of cutting up birch-bark and paper into the shape of palm-leaves, when both kinds of material more naturally lent themselves to other (square) forms, which for writing purposes one would have thought to be obviously more convenient than the long narrow strips of palm-leaf? What else could have caused this, but the sanction of immemorial usage among the literary classes of India, the learned and the "religious," those who occupied themselves with the composing and copying of books; and with the spread of Indian culture, through the Buddhist propaganda, its fashions of writing went with it beyond the borders of India. At the same time the circumstance that they imitated the oblong shape of the palm-leaf rather than the squarish shape of the birch-bark leaf clearly points to the conclusion that the writers of the manuscripts in question either came from Western India, or, at least, were influenced by the literary customs prevailing in that part of India—the part which is included in Alberuni's Southern India.<sup>24</sup>

This suggests another thought. The Corypha palm is a South Indian tree. Its leaves established that immemorial and so strongly

<sup>23</sup> See my paper in the *Journal, A.S.B.*, Vol. LXVI, pp. 257, 258.

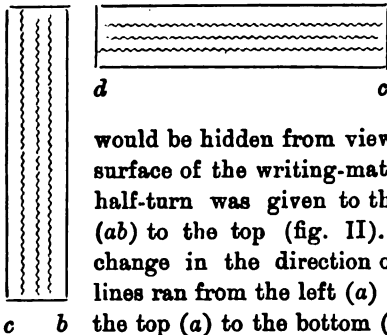
<sup>24</sup> This view is confirmed by the circumstance that the leaves of some of the Weber and Macartney MSS. are numbered on their obverses. This, as the late Professor Bühler has pointed out (see *Vienna Oriental Journal*, Vol. VII, p. 261), is a custom of Southern India. In Northern India the numbering is on the reverses. We thus seem here to come across a curious indication regarding the particular part of India from which the Buddhist propaganda proceeded to Eastern Turkistan. We should have to look for it in South-western India.

persistent fashion of shaping the writing material, even when it was birch-bark or paper. The people who used those leaves and thus initiated that fashion, must have been the first to learn and adopt the art of writing in India. The late Professor Bühler, in his excellent paper "On the Origin of the Indian Brāhmī Alphabet" (*Indian Studies*, No. III) and in his *Indian Palæography* (*Encyclopedia of Indo-Aryan Research*, Chap. I, § 4), has shown it to be most probable that the Indian Brāhmī script is derived from a Northern Semitic alphabet and he suggests that it probably came by way of Mesopotamia and the Persian Gulf. I agree with Professor Bühler; only I believe the original of the Brāhmī script to have been, not the Phœnician alphabet of the 8th or 9th century B.C., but the Proto-Aramæan of the 7th or 6th century B.C. All the trustworthy evidence, at present available, points to the conclusion that the maritime commerce of India with the West cannot have commenced before the 7th century B.C., and that it ran from the west coast of India through the Persian Gulf to Mesopotamia. At that time, there existed a flourishing land-trade between Mesopotamia and the further West through the North of Arabia. The Indian sea-trade connected with this land-trade. The latter had a script, common to all the peoples that participated in it, and it must have been this script with which the Indian merchants and mariners became acquainted in the 7th and 6th centuries B.C. This script which may be called the Proto-Aramæan, was a cursive development of the Phœnician, and owed its origin to the need of a popular short script by the side of the more cumbersome cuneiform. Further all available evidence seems to show that, though there probably existed a coasting-trade all along the west-coast of India to Ceylon, the Indian sea-trade to Mesopotamia started from the northern part of the west-coast, above Bombay, in the Gulf of Cambay, where the two ancient ports of Bharoch and Supārā, already mentioned in the Jātakas, are situated. It is here, in the north-western part of Southern India that the Brāhmī script must have originated, say, between 650 and 550 B.C. It was here that the Proto-Aramæan script was introduced by the Indian mariners, and elaborated into a new script by men belonging to the literary classes of India for the benefit, primarily, of the mercantile classes. These men would not have been slow to notice the advantage of the new importation, and they would naturally alter and enlarge it, and generally adapt it to the needs of their own language and literature. The details of this process of adaptation have been very well worked out by Professor Bühler in his papers above cited. But what I wish to point out is that the three principles on which Professor Bühler shows the adaptation to have been made are most easily accounted for, if we remember the nature of the

writing material to which the Proto-Aramaean script had to be adapted. Professor Bühler accounts for them by "a certain pedantic formalism" of the Indians. But they are far more naturally accounted for by the fact that the South Indians adopted the Corypha palm-leaf to write upon, and took to the fashion of scratching their letters on them. Why they should have chosen palm-leaves and the method of scratching on them, is another question which it would be interesting to explain. But anyhow, as a matter of fact, they did make their choice in that way. And having done so, the principles above referred to followed almost as a matter of course. Considering the venation of the palm-leaf (cross-veins running at right angles with the length of the leaf), one could only scratch letters with comfort on them, if they were made "of vertical lines with appendages attached at the foot" instead of the top, and "set up straight." Considering the extreme narrowness of the palm-leaf (about  $2\frac{1}{2}$  inches at most), admitting only a very small number of lines, the letters had to be "made equal in height," lest space was wasted.

In connection with this another point comes in. The Semitic script runs from the right to the left, while the Brāhmi runs from the left to the right. So far as I know, it has never been satisfactorily explained what could have induced the Indians to introduce the change. The boustrophedon method of writing which is supposed to account for the same change of direction in Greece, will not serve as an explanation; for that method has never been observed in any Indian inscription, nor is it ever noticed in Indian tradition. I should like to suggest the following explanation. The original writing material of the Indians were very narrow oblongs: bamboo-slips or palm-leaves. On these they probably wrote (as also the Chinese do) originally in vertical lines, parallel with the longer

*d* I *a a* II *b* side, (*ab* in fig. I) and running, after the Semitic fashion, from the right (*a*) to the left (*d*), every letter also facing left. With this method of writing the earlier-written lines would be hidden from view by the hand as it moved across the surface of the writing-material. To avoid this inconvenience, a half-turn was given to the latter, so as to bring its longer side (*ab*) to the top (fig. II). The consequence was a complete change in the direction of writing; for now the letters on the lines ran from the left (*a*) to the right (*b*), and the lines from the top (*a*) to the bottom (*d*), parallel with the longer side (*ab*) as shown in fig. II. This is precisely the way in which all existing Indian *pothis* are written. By the half-turn, given to the



material, all the letters written on it would also be placed on their sides, and to obviate this inconvenience, they were again set up straight, but now usually facing in the opposite direction. The original practice of vertical writing may have had a cause similar to that above suggested for the half-turn of the material: or it may have been due to the inconvenience of frequent breaks of continuity in writing extremely short horizontal lines (parallel to *ad* in fig. I).

This paper was read to the Society in May 1898. Its publication was delayed, in the hope that I might be able to add the results of an enquiry into another source of evidence. But as my work on the British Collection of Central Asian Antiquities will prevent this for some time, it seems better to present the evidence as it stands at present, especially as it is of such a direct and reliable character. The other source I refer to is the occurrence of the names of the *Corypha* and *Borassus* palms respectively in ancient Indian literature. When the date of an ancient work is known, exactly or approximately, one would suppose the occurrence in it of the name of the palms should be a proof, first, of their existence in India at that time, and secondly, of the use of their leaves as writing material. This seems a perfectly sound assumption, but there are several pitfalls to be guarded against: (1) is the date assigned to the work reliable; (2) is the passage in which the name occurs genuinely old, or possibly a later interpolation; (3) is the application of the terms to the palms in question certain? I have not been able to spare time for the examination of this source of evidence; but I may just mention a few instructive cases to illustrate its difficulties.

(1) Professor Hara Prasad Shastri has drawn my attention to a passage in the *Lalita Vistara* (*Bibliotheca Indica* Ed., p. 526, l. 12), in which the fruit of the *Borassus flabellifer* is supposed to be referred to. As the *Lalita Vistara* certainly existed as early as the 3rd century A.D. (having been translated into Chinese in 308 A.D.), we should thus have a testimony to a very early existence of the *Borassus* palm in India. The passage runs as follows: *tad-yath=āpi nāma Tāla-phalasya pakvasya samanturavṛṇṭa-cyutasya bandhan-āçrayaḥ pīta-nirbhāso bhavati . . . . . , evam=evu Bhagavato Gautamasya . . . . . pariçuddham mukha-maṇḍalam, etc., i.e.,* "Just as the exocarp of the ripe fruit of the *Tāla* palm, when it drops from its stalk, is of a brilliant yellow, even so is the face of the Blessed Gautama perfectly pure." On referring this passage to Dr. Prain, I received the following reply: "My only objection as a botanist to the identification of *Tāla-phala* with either the *Tāla* or *Tāli* palms, *i.e.,* with either the *Borassus* or the *Corypha*, is that the *bandhan-āçraya* (exocarp)

of both is *anything but* 'brilliant yellow.' The fruit of *Borassus* is 'rusty brown,' that of *Corypha* 'grey,' when they have respectively dropped from the stalk. Of course, there is a Palm, and that too one which is undoubtedly a native of northern India, with fruits that when ripe *do* most thoroughly deserve the description 'brilliant yellow.' This is the *Kajūr* or wild date. The difficulty then, of course, is the name; was *Tāla* ever commonly applied to what is now more generally known as *Kajūr*? I find that Dr. Watt has been informed (see his Dictionary under *Phoenix dactylifera*, the Date, and *Phoenix sylvestris*, the wild date, which is not really botanically separable from the cultivated tree) that in Sind, where, by the way, according to Mr. James and Mr. Strachan *Borassus* is not grown, one of the names of *Phoenix dactylifera* is *tār* to this day, and that in the Panjāb the name *Tārī* is still applied to the juice (taken to make Toddy) of the wild date, *Phoenix sylvestris*." This seems to me to speak for itself, and shows the necessity of caution in dealing with botanical terms occurring in old Indian literature.

(2) In the Introduction to the *Jātaka* book there occurs the following passage: *puratthābhimukho nisiditvā ekaññhitāla-pakkappamāṇe ekūnapaññāsa piṇḍe katvā sabbam appodakam madhupāyāsam paribhūñji*, i.e. (as translated by Mr. Warren in his *Buddhism in Translations*, p. 74) "setting down with his face to the east, he made the whole of the thick, sweet milkrice into forty-nine pellets of the size of the fruit of the single-seeded palmyra-tree, and ate it." The meaning, of course, is that Buddha ate the milkrice in 49 mouthfuls. The passage occurs in the story of the dish of milkrice which was given by Sujātā to Buddha shortly before his enlightenment. I referred this passage to Sir George King who replied "the fruit of *Borassus* is too big to be likened to the ball which a native of India makes up when he eats rice. So I presume *Corypha* must be the species of *Tāla* meant. Its fruit is small, globular, and not longer than a walnut. The fruit of the Palmyra is of the size of a closed human fist or a cricket-ball." Measured by it the milkrice, and the "mouthful" would have been an enormous quantity. By the way, the expression "single-seeded" is curious. The rule with all palms is a single seed. The only Indian palm, which, as Sir George King informs me, has occasionally two seeds in its fruit is the *Caryota urens*, which is common enough in India and Ceylon. If the writer of the Introduction to the *Jātaka* book knew that the *Caryota* had sometimes two seeds, it would explain his applying the term "single-seeded" to the *Corypha*.

(3) There is a well-known passage in Arrian's *Indica* (Ch. VII), in which Megasthenes is quoted as saying: "They (the Indians) eat the inner bark (φλοῖός) of trees; the trees are called in the speech of the

Indians *tala*, and there grows on them, just as on the tops (κορυφή) of the date palms (φοίνιξ), something like balls of wool" (οἰάπερ τολύπας). It is commonly assumed that the *tala* tree is the Borassus, and that the "something" means its fruit. But Megasthenes cannot have referred to the fruit of the tree; he clearly meant something, the nature of which he did not know; it was neither fruit nor flower, but could only be described by its resemblance. Anyhow the whole description of the tree fits neither the Borassus nor the Corypha palm. The only Indian palm which agrees with some items of the description is the *Caryota urens*. The pith of it yields sago; and tufts of a kind of woolly stuff grow at the points where the leaves join the stem (see Yule's *Friar Jordanus*, p. 17, Hackluyt Soc., 1862). These may have been intended by the "inner bark" and the "something" of Arrian. But neither the tufts, nor the fruit of this palm—and, indeed, of any palm—grows on its "top," and the reference to the date-palm remains unintelligible.

One thing is clear. The common assumption in all the dictionaries (Sanskrit or Pali) and translations that *tāla* always means the Borassus or palmyra, and *tāli* the Corypha, is quite unfounded. *Tāla* is simply the generic name of any palm, and the context must show which palm is intended in any particular case. This is certainly the case with the older Indian literature, whatever the modern usage may be.

With reference to page 124, I may now add that the earliest evidence that I can find of the existence of the Borassus palm in India, occurs in Friar Jordanus' *Mirabilia descripta*, in 1328 A.D. He calls the tree *tāri* (or *tāli*), and says that it "gives all the year round a white liquor pleasant to drink." (See Yule's *Hodson Jobson*, s.v. Toddy). The reference to the "toddy" shows that the Borassus palm is meant.



*A collection of Ladakhi Proverbs.*—By THE REV. H. FRANCKE, Moravian Missionary, Leh. Communicated by the Philological Secretary.

[Read June, 1899.]

The Ladakhi word for proverb is *gtamdpe* [pronounced *stamspe*] which means 'word example.' *Stamspe* is the general term for what might be called quotations, the shepherd's calender and the popular moral code.

Ladakhi popular poetry has become famous for the frequent application of the laws of 'parallelism.' Many beautiful examples, illustrative of this form of poetry, will be noticed in the proverbs.

In the following each proverb will be treated in this way—

- (a) the Proverb in the orthography of Ladaki letter writing, (b) pronunciation, (c) literal translation [does not claim to be good English], (d) application, (e) grammatical and other notes.

Concerning the orthography of (b) the following will suffice: The vowels are the Italian vowels<sup>1</sup>, *ā* rather like *e*. All accents given, refer only to the stress. *sh*= $\text{sh}$ , *zh*= $\text{zh}$ , *ng*= $\text{ng}$ , *c*= $\text{c}$ , *ch*= $\text{ch}$ , *j*= $\text{j}$ , *ts*= $\text{ts}$ , *ths*= $\text{ths}$ . The unaspirated Tenuis holds the mean between English tenuis and media. Single *r*=Hindustani *r*. The *r* preceding a consonant is like the German guttural *r*, following a consonant it is like the English *r*, spoken quickly.

#### THE PROVERBS.

1. (a) དཔེ་ཉིད་རིང་མོ་ལ་བྱང་གསུམ་དང་རྩོ་གསུམ།

མི་ཚོ་རིང་མོ་ལ་སྦྱིད་གསུམ་དང་སྦྱུག་གསུམ།།

- (b) *spid' nyin ring'moa drang' sumdang dro' sum*  
*mi'thse ring'moa skyid' sum dang dug' sum.*

<sup>1</sup> They are long, when ending a syllable, short in all other cases.

- (c) On a spring day [there are] three colds and three warmths  
In a lifetime [there are] three happy [hours] and three  
unfortunate [hours].
- (d) Misery and happiness are well balanced in man's life.
- (e) *Spid nyin* is a *Compositum determinativum* formed from  
*spidka* and *nyima*. Also *drangsum*, *drosom*, etc., must  
be considered as *Composita*, which accounts for the  
missing articles; the termination *la* to be pronounced *a*.
2. (a) སྐད་སྤུག་མི་ལ། མཛེར་བ་ཤིང་ལ།
- (b) skyid'dug mi'la, dzer'pa shing'la.
- (c) Fortune [comes] to man, [as] a knot to the tree.
- (d) No man knows the cause of a knot in a tree, just so  
unexpectedly misery and fortune come to certain  
people.
- (e) *Skyiddug* is *Comp. copulativum*.
3. (a) ཐིག་ས་པ་བསག་ན་གྲུ་མཚོ་གང།
- (b) thigs'pa sag'na gya'thso gaug'.
- (c) If drops gather, [there is] a full ocean.
- (d) *Gang*, though of verbal derivation, is often used without  
an article to express the adjective "full."
4. (a) མུ་སྐྱའི་ནག་རང་དང་ལྷུག་ཁོག་ཟམ།  
སྐྱེལ་མདོས་མོ་ཆེ་དང་གཡག་ཁོག་ཟམ།
- (b) Ma'shroi nag'rang dang lug'khog zam'  
slel dos'moche dang yag'khog zam'.
- (c) With [at the time of] the *nagrung* festival at Mashro  
[the heat] is as great as the body of a sheep.  
With the *dosmoche* festival at Leh it is like the body of  
a Yak.
- (d) From the peasant's calendar. Because the festival at  
Leh is celebrated several weeks after that in Mashro,  
it is warmer then.
- (e) *Maspro* = great joy. Though in this proverb the  
original pronunciation of Leh = *slel* is retained, in  
ordinary speech *s* and *l* are dropped; final *l* shows a  
great inclination to disappear. Sheh, a village on the  
Indus, was originally spelt *shel*—crystal, because crystals  
are found in the surrounding hills. *Gyapo* is said  
instead of *gyalpo*, etc. *Slel* is supposed to have been



corrupted from *lal*, ruby, it having been the ruby in the crown of the old Ladakhi kings. *Dosmoche* and *nagrang* are both non-buddhist festivals. Although the *klu's* or water-snakes have nothing to do with them, they are Bon festivals, but attended by many buddhist priests and laymen. All evil spirits of the winter are driven into a cake, which is burnt outside the village. In Leh the fetish is formed of *mdosmo's*, see Jäschke's dictionary. In Mashro it is a black one. According to a different derivation this festival is called 'the black one' on account of the black coat of *Langdarma's* murderer whose deed is praised then.

5. (a) དཔེ་སྤྱུག་གི་དགུ་བཀོད་དང་ལྷུག་ཁོག་ཟམ།  
 (b) spithüggi rgu'stor dang lug' khog zam'.  
 (c) At the time of the *rgustor* festival at *Spithug* [the heat] is like a sheep.  
 (d) Often said instead of the former.  
 (e) The name of the village *Spithüg* is said to have been formerly *dpethug*, 'the arrived at likeness.' The monastery of *Spithüg* was built after the picture of a famous monastery in Lhassa. *Rgustor* is a *Comp. determ.* composed of *nyergu*=29 and *storma*, offering. The devils are urged to enter a large cake, offered to them and the cake is burned outside the village. 29 is the date of the festival.
6. (a) ས་ལ་སྤྱི་རེ་ལྗང་། མི་ལ་སྤྱི་དེ་སྤྱུག་རེ།  
 (b) sa'la skya're sngo're mi'la skyid're, düg're.  
 (c) On the ground [it is] alternately grey and green, with man [there is] one turn fortunate, one turn unfortunate.  
 (d) See 1 (d).  
 (e) In Ladakhi a single *re* has often the meaning of some, for instancee *lorela*, in some years. Here *re* forms *Composita* with *skyabo*, *sngonpo*, etc.
7. (a) ཁ་ལ་སྤྱི་དེ་ལྗང་དུས།  
 ཅི་གོན་འབྲུད་དེ་ཅི་ཟེ་ཡི་དུས།  
 (b) kha' ran'gu khor'dus, ci' gonbud'de, ci' zä dus'.

- (c) The time when the fly turns [flies] round the mouth, is the time of taking off all clothing and eating everything.
- (d) A description of summer in the peasant's calendar.
- (e) About *kha* instead of *khala* see 1 (e). If an *r* follows a *muta*, the *muta* is often dropped in Ladakhi, thus *rang* is said instead of *brang*; *ci* 'what' is used here in the sense of whatever.
8. (a) མཁར་རྫོང་དི་གཡའ་རྒྱལ་ལྟ་ལྟ།  
རྒྱལ་སྤྱིའི་ལྟ་ལྟ་ལྟ་ལྟ་ལྟ།
- (b) *khar'zongi yachula lta'lta,*  
*chu'bii ldam'chu yang bud'.*
- (c) Whilst looking at the glacier water of the Kharzong pass the gathered water of Chubi (a village) is also lost.
- (d) take what is nearest!
- (e) refers to the system of irrigation. Notice the re-duplication of the verb, implying a durative sense = whilst.
9. (a) ར་མའི་ཁྲོའ་གོ་ཅ། ལུག་གི་ཁྲོའ་བེ་ཡ།
- (b) *ra'mā thro'a go'a, lug'gi thro'abe'a.*
- (c) In the company of goats [he says] *goa*, in the company of sheep [he says] *bea*.
- (d) Said of a man, who has no will of his own,
- (e) *Goa* and *bea* imitate the voices of goats and sheep respectively.
10. (a) དཔིད་འབད་དུས། ལྷོན་སྤུ་དས།
- (b) *spid'bad'dus' ston'rdu'dus'.*
- (c) Spring is the time of working, autumn the time of gathering.
- (d) Do everything at the proper season.
- (e) The two sentences consist each of a three-syllabled  
*Comps. determ.*
11. (a) དཔིད་འབད་དུས་ལ་མ་འབད་ན། ལྷོན་སྤུ་དུས་ལ་འགྱོད་འདུག།
- (b) *spid' baddusla mabad'na, ston'rdudusla gyod'dug.*
- (c) If you do not work in the spring working time, you will repent in the autumn gathering time.
- (e) Notice the change of *s* into *r* in *rdu* = gather.

12. (a) ལ་དུགས་ཀྱི་ཞིང་མེས་དང་མཉམ་བོ་འབྲུག་མིར་ན།  
མདོ་གཤི་ལིད་ལ་སྟོན་ཐོག་ཐོབ་འདུག།

(b) Ladag'skiy zhing'shmos dang nyam'po drug' ldir'na,  
do'sha gil'idla ston'thog thob'dug.

(c) When at the time of ploughing in Ladakh the thunder sounds, they receive a harvest in *dosha* [lower Ladak] and Gilgit.

(d) Peasant's calendar. Lower Ladak and Gilgit have an earlier harvest than Leh.

(e) *Ldirces* is the Ladakhi for *adirba*. In this Proverb the Genitive in *kyi* is pronounced in full. The ordinary Ladaki Genitive has a simple *i*.

13. (a) ཡུན་རིང་ན་བྱ་རོས་ལྡོང་བོ་ཚོད།

(b) yünring'na ja'ros ldong'bo chod'.

(c) After a long time a dead bird [which is blown by the wind against the trunk of a tree] cuts the trunk.

(d) With perseverance great things can be done.

(e) *Ldongbo* = *sdongbo*.

14. (a) གླང་ལྷས་ཀྱི་ཡང་མལ་ལྷ་ལྷ།

དབི་བྲག་གི་སོ་སྟོབ་ཡང་འབྲུད།

(b) gang'lessi yang'mala lta'lta.

spid'thuggi sor'gob yang bud'.

(c) Whilst looking at the good barley of Gangles (a village) the rough straw of Spithüg is lost.

(d) See 8 (d).

(e) About *lalta*, see 8 (e).

15. (a) བྱ་ཚང་མ་བྱ་ཡུལ་ལ་སོང།

བྱ་ངན་བྱ་ཏུ་ཅོ་ཤལ་མཐུག་ལ་ལུས།

(b) ja'thsang'ma ja'yulla song'

jangan' ututu'tse shul'juglalus'.

(c) All birds have gone to birdland.

The bad [stupid] bird hoopoe has remained to the last.

(d) When a bad thing has been done by several, all who can, disappear, the one who remains, is punished for all.

16. (a) དབྱུང་ཉིན་ལོག་སྟེ་མན་ནས་དོད་མི་དབབ།  
 དབྱུང་ཉིན་ལོག་སྟེ་མན་ནས་བྱང་མི་དབབ།
- (b) yar'nyin log'ste man'ne drob' mi bab',  
 gun'yinlog'ste man'ne drang' mi bab'.
- (c) Unless the summer-day returns, heat will not come down.  
 Unless the winter-day returns, cold will not come down.
- (d) Everything will come at the proper season.
- (e) *Mannas*, a gerund of *man* = to be not, used in the sense of unless, besides, etc., *yarnyin*, *gunnyin*, see *spidnyin* in 1.
17. (a) མཚན་ལྷོད་ལ་དཀོན་མཚོག་ལ་གསོལ་བ་བདེ་བ་དགོས།  
 མཚན་དཀྱིལ་ལ་གཉིད་ལོག་དགོས།  
 མཚན་སྤྲོད་ལ་འཇིག་རྟེན་གྱི་ལས་ལ་བསམ་བ་བདང་དགོས།
- (b) thsanstod'la konchog'la so'va tab'rgos  
 thsanskyl'la nyid'log rgos.  
 thsan smad'la jig'stenni las'la sam'ba tang' rgos.
- (c) In the first part of the night you must pray to God.  
 In the middle of the night you must sleep.  
 In the last part of the night you must think of the work of this world.
- (e) For *sova* instead of *solva*, see 4 (e). In *dgos*, must, the *d* is turned into *r*, *rg* is pronounced like *ch* in Loch, lake.
18. (a) འཕ་བ་རི་དྲུགས་རི་ན་འབྲུལ་བ་མིག་གི་རྒྱན།  
 དམན་ཚར་མོ་སྤང་ན་འབྲུལ་བ་ཡིད་ཀྱི་རྒྱན།
- (b) sha va ri'dags ri'na drul'va mig'gi gyan',  
 sman thsar'mo shrang'na drul'va id'kyi gyan'.
- (c) The deer Shava walking in the hills is the delight of the eye, a fine girl walking in the street is the delight of the heart.
- (e) Notice the classical Participle in *va* in *drulva*. In proper Ladakhi the ending *khan* would be used.
19. (a) ལྷག་སྤྲི་ཤོ་རེས་མ་སྤྲི་ཤོ་རེ་ལ་ཁྲེལ་འདུག།
- (b) Stag'nä sho'res Mash'roi sho'rela threl'dug.
- (c) The harelipped man of Stagna [a village] laughs at the harelip of Mashro.

- (d) Everybody sees only his neighbour's fault, not his own.
- (e) *Stagna* = tigersnose, on account of a bill of such shape. In the Instrumental *shores*, the *s* is pronounced distinctly, although in pure Ladakhi *shores* would be spoken *shorei*.
20. (a) རྒྱུ་ཚོ་ལ་ལྟ་མཁོ། ཉེ་ལ་སྤྲོད་བརྒྱུ་མ་བཏང།།
- (b) chu'ithsod'la lta'ste, nya'la bar'zum ma tang'.
- (c) Do not grasp a fish, unless you know the depth of the water.
- (d) Do not accuse a man before the court, unless you know how rich he is. (Refers to the former bad management of justice in Ladakh).
- (e) The *ma* = not, of the second sentence silently refers also to the first.
21. (a) ཏ་ཞོན་མགོ་ཆག། བོང་ཞོན་ལག་ཆག།།
- (b) sta'zhon go'chag, bong'zhon lag'chag.
- (c) Horse-riding [may cause] head-breaking, donkey-riding [may cause] hand-breaking.
- (d) It is safest to remain low and humble.
- (e) The two sentences consist each of a two-syllabled *Comp. det.*
22. (a) ཏ་ལ་མིག་པ་རྒྱུ་བ་ཅེས་མཐོང་མེ།  
བོང་བུའི་ར་གོ་མ་རྒྱུང།།
- (b) sta'la shmig'pa gyab'ces thong'ste, bon'gui ra'go ma skyang'.
- (c) Seeing [them] shoeing a horse, you must not stretch the donkey's foot [for shoeing].
- (d) Do not imitate high people and become a fool.
23. (a) བྱ་ལོན་མེད་ན་ལག་མི་དང།  
ཚོར་ཀ་མེད་ན་དྲ་གཞན་ཉེས།།
- (b) bu'lon med'na lag'midang' thser'ka med'na star'gan nyos'
- (c) If you have no debts, you may be security for another; and if you have no sorrow, buy an old horse!
- (d) A rich and happy man may do some stupid thing.

24. (a) ལ་སྲ་ཤི་ཡིན་བསམས་བིན་ན།  
 ཏྲ་རྒྱན་ཞིག་ལ་ཅི་ལ་མ་བཅོངས།།
- (b) a'ba shi'in sam'spinna  
 star'gan cig'la cila ma tsong's.
- (c) If you thought [knew], that father will die,  
 Why did you not sell him [before dying] for an old horse.
- (d) Used derisively. You could not help your misfortune  
 just as you cannot sell your father.
- (e) *Samspin* a contraction of *bsamspa yin*.
25. (a) བ་ཟོད་པ་ལྟ་བུའི་དགེ་བ་མེད།  
 ཞེ་སྤང་ལྟ་བུའི་སྲིག་པ་མེད།།
- (b) zod'pa lta'bui ge'va med  
 zhed'dang lta'bui dig'pa med.
- (c) There is no virtue like patience ;  
 There is no sin like hatred.
26. (a) ལྷ་མ་རང་མགོ་མ་འཕྲོན་ན།  
 བཞིན་པའི་ཡར་འཕྲོན་ཅི་བཅོ་ཡིན།།
- (b) La'ma rang'go ma thon'na  
 shin'poi yar'dren ci co'in.
- (c) If the Lama's own head does not come out [cleanly],  
 how will he manage (do) the drawing upwards of the  
 dead.
- (d) Used for deriding the immoral life of the lamas.
- (e) *Thonces* is verb neuter of *btonces*, to put out.
27. (a) ཤི་སོང་ཤི་སོང་ཟེར་ན།  
 བཞིན་མིག་རི་ནས་ལྟ་ཡིན།།
- (b) shi'song shi'song zer'na  
 shin'mig ri'nā lte'n.
- (c) If you say " he is dead, he is dead,"  
 The eye of the dead will look out of the hill.
- (d) Ladakhi superstition. It is not good to speak much of a  
 dead man, his eye might frighten the speaker.

- (e) For the *n* in *shinmig* or *shinpo* see also *nyin* derived from *nyima*. Syllables ending in a vowel are inclined to add a final *n*, see also *mentog* from *metog* and many others.
28. (a) རང་སྐྱོན་ཕད་གང་འབོར་ཏེ།  
སེ་སྐྱོན་སྐྱེ་གང་ལ་མ་བྲིལ།།
- (b) rang'skyon phad'gang bor'te  
mi'skyon rgye'gangla mathrel'.
- (c) Putting aside the large bag [*phad*] filled with your own faults, do not mock at the little bag [*rgye*] of your neighbour's faults.
- (e) *Rang skyonphad gang* and *misky on rgye gang* are *Compos. determ.* Notice the change of *s* into *r* in *rgye*.
29. (a) རང་གཞོང་མ་མཐོང་སྟེ།  
སེ་གཞོང་ལ་ལྗང་མོ།།
- (b) rang'dong ma thong'ste  
mi'dongla stad'mo.
- (c) Not seeing your own [ugly] face, [you make] a scene about your neighbour's face
- (d) See 28.
- (e) *Ltadmo* derived from *ltaces*, to look at.
30. (a) ལག་ཤེས་ཀུན་གྱི་གཡོག་པོ་ཡིན།  
གངས་ཤེས་ཀུན་གྱི་དཔོན་པོ་ཡིན།།
- (b) lag'shes gun'gyi yog'po in'  
stam'shes gun'gyi spon'bo in.
- (c) Who is clever with his hands, is servant of all, who is clever in his speech, is master of all.
- (e) The ending *gyi* is retained here. The proper Ladakhi would be *gunni*. The silent *g* and *d* in *gtam* and *dpon bo* become *s*.
31. (a) རྩག་པོས་འགས་པོ་ལ་མ་བྲིལ།།
- (b) chag'poe gas'pola ma threl'.
- (c) What is broken, must not laugh at what is cracked.
- (d) See 28 and 29.
- (e) *Chagpo* and *gaspo* are substantives derived from verbs.

32. (a) མ་ཤི་ཚེ་རིང་འདུག་ན་སྲན་མའི་སྲན་ཆང་ལྷེར་ཡིན།།  
 (b) mashi'thse ring'dugna shran'mä shran'chang ster'rin.  
 (c) In the time I live, not die [before I shall die] I shall give you a beer of peas.  
 (d) A threat. Before my death I shall find some opportunity to give you a severe beating. The beer of peas is said to be of a very bad taste.  
 (e) *Mashithsering* is a *Compos. adverb. and copulat.*
33. (a) མ་བུ་བྲམ་ས་སྲན་ཆ་ན། ཚལ་སྒོ་ཚོད་སམ་ཚོད།།  
 (b) ma'bu drabs'thun cha'na  
 thsalrgo thsod'mä chod'.  
 (c) If mother and daughter agree in their counsel, breakfast may pass off well with vegetables [only].  
 (d) Much displeasure can be avoided by talking over a thing, before doing it.  
 (e) *Mabu* is *Compos. copulat. drabsthun comp. determin.*
34. (a) བསམ་པ་སྒྲིན་ལ་མ་བཏང་ན།  
 འགྲོད་པ་དྲིང་ན་ཡོང་འདུག།  
 (b) sam'ba ngon'la matang'na  
 gyod'pa sting'na yong'dug.  
 (c) If you do not give thought first, repentance will come afterwards.
35. (a) བོང་དུའི་ན་མཚོག་ལ་སེར་སྒྲིག་ན། ཡང་ན་ཐལ་བ་སྒྲིག་ན།  
 ཚོགས་ཡིན།།  
 (b) bon'gui nam'chogla ser'lugna yangnathal'ba lugna, tsogs'in.  
 (c) It is all the same whether you pour gold in the ear of a donkey or dust.  
 (d) Excuse of the lamas, when asked, why they do not teach the people.  
 (e) In *namchog* as in many other words the silent letter of the second syllable is pronounced with the first.
36. (a) སྒན་མ་སྒྲིག་བརྒྱབ་ན། རྟོང་མ་དགོད་མ་ཤོར།།  
 (b) ngan'ma rgag'gyab'na, sting'ma rgod' ma shor'.  
 (c) When the man who walks first, stumbles, the man following behind, must not laugh.



- (d) Do not laugh at another man's misfortune, the same might easily come to you.
- (e) The second sentence in full would be: *stingmanas rgod ma sñor*, from the follower a laugh must not flee.
37. (a) ལྷག་སྐྱ་ནས་བྱི་ཡོང་འདུག་ཟེར་དེ།  
 ཞེ་འབྲུག་ནས་རྩོལ་འཁྲར་དེ་ཆ་རྩལ།།
- (b) *stag'nanä khyi'yongdug zer'te zha'bugnä rdo'a khurte cha'rng.*
- (c) Saying there comes a dog out of Stagna [a village four miles from Zhabug] they go carrying stones out of Zhabug.
- (d) Do not be afraid, there will be a helper.
- (e) *Zhabug = zhabub = falling headlong into a bog; charug = cha'adug; the d of 'adug becomes an r after a stem ending in a vowel.*
38. (a) མི་ངན་ཚོགས་གསེབ་ལ་ཆ་ན།  
 ཤིང་ངན་ཏུ་ཀྱང་འབྲུག།
- (b) *mi'ngan thsogs' sebla cha'na shing' ngan ta'ku dang thug'.*
- (c) When a bad man goes into the middle of a forest, he meets [finds] only with bad crooked wood.
- (d) A bad man sees only bad things and persons about him.
- (e) *Taku* is the Ladakhi for crooked, crippled, ill-shaped.
39. (a) མི་ལ་སྦྱིད་མི་ཐག།  
 ར་ལ་ཚོལ་མི་ཐག།
- (b) *mi'la skyid' mithag' ra'la thsil' mi thag'.*
- (c) Man cannot bear good fortune, [just as] a goat cannot bear [eat] grease.
- (e) *Thagces = thegpa.*
40. (a) བྱི་ལ་སྐྱལ་དང་བེ་རྩལ་ཤོ།།
- (b) *khyi'a sgal'dang be'daa shol.*
- (c) To the dog is a load, what the plough is to a musician.
- (d) Certain people cannot be expected to do real work.

- (e) For *a* instead of *la*, see l. *Beda* is supposed to have been originally འབྲེ་གའོལ, *bedol*, a travelling outcast man, about the dropping of final *l*, see 4 (e); *o* and *a* often change in verbal roots.

41. (a) ཏས་འཕང་སྤྱོད་ངམ། དཔོན་བོས་བཀྱོན་སྤྱོད་ངམ།།

- (b) stä'phang nyo'ngam, spon'boe kyon'nyon'gam.  
 (c) Do you suffer from being thrown off the horse or from being scolded by your master.  
 (d) Ironical inquiry, when a person is not in good spirits.  
 (e) There the classical ending *am* of the question is retained, the Ladakhi has only *a*.

42. (a) ལྷུ་གྲུ་ལ་དཔེ་ར་དང་བཅུན་རྩུང་ལ་ཇུ།།

- (b) thrug'ula spe'ra dang tsun'jungla ja'u.  
 (c) Speech [of adults] is to a child, what a *jau* is to the *tsunjung* [the lama apprentice].  
 (d) It is not good to speak of everything before children, just as the *tsunjung* is not deemed worthy to receive a *jau*, [after having taken part in a religious ceremony].  
 (e) *Spera* is originally *dpe sgra*, for *ra* instead of *sgra*, see 7 e. *jau* = a little tea, because everything used to be bought with tea in Tibet, a Tibetan silverjau = 3¼ annas, *btsunjung* = *btsunchung*, see Ladakhi Grammar, laws of sound 6.

43. (a) ཁ་དམ་ཀོ་ལྷག་ཟེར་ས་དང་སྐྱ་མའི་འོ་ལྷང་ཟེར་ས་ལ་སྐྱེབ་འདུག།

- (b) kha'tä ko'wag zer'sa dang' la'mä tro'wang zer'sala hleb'dug.  
 (c) He arrives at the place where the crow says *kowag* and [then], where the *lamas* say *trowang*.  
 (d) Used derisively of a man, who has nothing to do and spends his life in dullness.  
 (e) *Zersa* is *Compos. determin. trowang* imitates the sound of the big drum.

44. (a) ལྷུ་ལ་ཏི་སྤྱིང་ཅན་ནི་སྤྱིང་བཀོལ་བཀོལ་ལ།

བོད་སྤྱིང་སེད་ཀྱི་སྤྱིང་སྤྱོར།།

- (b) bal'ti nying'canni nying' kolkol'la  
 bod' nying med'kyi nying stor'.

- (c) [Looking] at the tricks of the plucky Balti, the heart of the timid Tibetan is lost.
- (d) An explanation of the constant bad luck of the West-Tibetans on the ground of the national character.
- (e) *Bkolbkol* is a word which seems to occur only in this connection.
45. (a) མཉམ་པོ་དུགས་པ་ལྷ་མ་ལ་ཁྱོད།
- (b) *nyam'po dug'spa la'maa khyod'*.
- (c) [When] living together, [we say] "thou" to a lama.
- (d) Respect is lessened by closer acquaintance.
- (e) *Khyod* is the common word for addressing inferiors or comrades. A lama ought to be addressed with *nyerang*; *dugspa = dugpar*. The Supine is sometimes used instead of the Gerund.
46. (a) མནའ་མ་མནའ་མ་རྩེར་ར་ནི་མིའི་ཡོག་མོ་ཡིན།  
སྐྱབ་ལ་གཡུ་ལྷང་བདག་ག་ནི་སེམ་པའི་མགོ་བསྐྱར་ཡིན།
- (b) *na'ma na'ma zer'ra ning' mi'i yog'mo in'*  
*gyab'la yu'zhung tag'ga ning sem'pä gob'skor in'*.
- (c) [Although they] call her daughter-in-law, she is the servant of men. On the back many turquoises are fastened, but it is a deceit of the soul.
- (d) Refers to the low position of the Ladakhi woman.
- (e) *Zerra* and *tagga* are corrupted from *zerbar* and *btagpar*. The supine used instead of the gerund = *gyuzhung = gyuchung* = small turquoises. See also *buzhung* or *buchung*. All Ladakhi women wear their turquoises on a strap of leather which is fastened on the head and descends to the middle of the back. *Semba = sems*, soul. *samba = thought*.
47. (a) ཁྱེད་ཀྱི་ལྷ་ག་རྩེར་པ། ལུང་ཀའི་མིག་འབྲུལ།
- (b) *Kha'tä ko'wag zer'pa, cung'kä mig' thrul'*.
- (c) The crow has said *kowag*; [in the] eye of the raven it is mistaken.
- (d) A man may say something very nice, [for instance *kowag*] his enemy will find great faults in it.
- (e) *Zerpa* is past participle; *cungka = skyungka*.

48. (a) ཟ་བོ་ཁྲ་ཏས་ཟེས། ལུང་ཀའི་ཁ་དམར་བོ།  
 (b) za'o kha'tā zos', cung'kā kha' marpo'.  
 (c) The [stolen] food was eaten by the crow [but the beak of the raven is red].  
 (d) Often the wrong person is caught instead of the guilty one.  
 (e) *Zos*=*bzas*, *zos* is the only past tense in Ladakhi, which changes the vowel.
49. (a) ཚོལ་མཐོང་སྤྱེ་ཁ་འགས།  
 (b) thsil'thong'ste kha'gas'.  
 (c) [When] seeing grease, the mouth cracks [open].  
 (d) When you see something nice you want to have it.  
 (e) *Thsil*=mutton grease, a very desirable thing in Ladakh.
50. (a) བོད་མེད་ཚོང་ས་ལ་ཆ་ན། ལྷོ་འདོད།  
 (b) nor'med thsong'sala cha'na, nyo'dod.  
 (c) Who goes to the shop without money, likes foolishness.  
 (d) Do nothing unprepared, you might be laughed at.  
 (e) *Nyodod* is *Compos. determ.*=a liker of foolishness.
51. (a) ལྷོད་ན་ལྷོད་ན་ངའི་སང་རྒྱལ་ལས་ལྷོད།  
 ལྷོད་ན་ལྷོད་ན་ངའི་སང་ལྷོད་པས་ལྷོད།  
 (b) stod'na stod'na ngā' sang gyal'lā stod'  
 smad'na smad'na, ngā' sang thus'pā smad'.  
 (c) Who praises me, is a better man than I am.  
 Who despises me, is a worse man than I am.  
 (d) Said by a man who has heard that slander is going on about him.  
 (e) For *sang* with the comparative, see Jäschke's grammar ; *rgyallas* and *thuspas* are Instrumentals, *gyalla*=a good man.

*A Primer of the Asur dukmā, a dialect of the Kolarian language.*—By THE REV. FERD. HAHN, German Evangelical Lutheran Mission, Choṭā Nāgpur. Communicated by DR. G. A. GRIERSON, C.I.E.

[Read December, 1899.]

INTRODUCTORY REMARKS.

The Asurs are a non-Aryan tribe of Choṭā Nāgpur, who number only about 2,500 souls. They chiefly inhabit the Districts of Rañchi and Palāmān and the Sargujā tributary state. Though small, the tribe is divided into several sections, viz., the Agōriā- the Brijīā or Binjhiā- the Lōharā- the Kōl- and the Pahāriā-Asurs. These sub-tribes are again divided into totemistic sections, which are similar in name to those found among other aborigines in Choṭā Nāgpur; as for example: Bes'erā=hawk; Ind=eel; Baṛeā=wild dog; Hōrō=tortoise; Būā=jackal; Rotā=frog, etc.<sup>1</sup> The chief occupation of the Asurs is melting iron and in the case of the Lōharā-Asurs the making of rude iron utensils and agricultural implements; besides they till the jungle in the most primitive manner. Their homes are made of wood, Bamboo and grass only and chiefly met with at the foot or even at the slopes of the hills which contain iron ore. When the land they have cultivated is exhausted they change their homes and move to another place in the forest.

As to religion the Asurs believe in a Creator and apparently identify him with the sun, whom they call Siṅboṅā; no worship however is rendered to him, since he is benevolent and does not require any expiation. It is peculiar that they do not know of any evil spirits except the manes of their ancestors, which alone are feared and to whom sacrifices are made; the latter exclusively consisting of fowls. The sacrificial altar is the fire-hearth. The Asurs have no priests, the

<sup>1</sup> These totems do not appear to be taboo to the members of its Sept, the only trace of such a thing is to be found in the restriction of intermarriage within the same totemistic Sept; but even here I was told by some men of the Bes'erā section, that they could not help intermarrying, since other sections were living too far away from their homes.

head of each family performs the required religious rites.<sup>3</sup> Every departed parent becomes a spirit and everybody who dies an unnatural death turns into a malignant one. After the death of a member of the household the regular meals are placed in his name outside the home near the door for eight days, after which the nearest relatives and friends come for the funeral meal at which they partake freely of "jhaṛi," Rice-beer, which they brew themselves. The Asurs burn their dead and put some rice on the funeral pile for the journey of the deceased beyond. They do not pick up any relics to keep or put by as other aborigines do. If sickness or any calamity visits the house of the Asur he is sure that some way or other a deceased parent has been disturbed, who must be quieted in the manner described above. The most peculiar feature, however, in the belief of the Asurs is the idea that ancestors or the spirits of the dead are re-born in their children.

The marriage ceremony is very simple, no priestly functions are required. Polygamy is permitted and so is the re-marriage of widows. The price of a bride varies from three to five rupees. Child marriages are unknown to the Asurs. Marriages within the totemistic section is not entirely prohibited, otherwise the common restriction is observed:—"Chachērā, mamōrā, phuphērā, musērā." The Asurs do not tattoo and ornaments are worn very sparingly. The Baby gets some anklets of iron to protect him from the evil eye of some person outside the tribe; within there are no witches or persons with evil eye. The Asurs are a stern race, have no musical instruments and seldom sing or dance. Rice-beer is indulged in by both sexes, but only men smoke. They are not very particular about their food and eat almost everything, even the flesh of the carcase of a cow.

I have tried almost in vain to find out any traditions or legends the Asurs might possess; all I could gather is, that they have a remnant of the Asur-legend so well known among the Muṇḍāris and Uṛāons:

There can be no doubt but that Asurs are the subject of this tradition, according to which they were destroyed by Siṅhoṅā, who ruled that their spirits should be worshipped. The meaning of this tradition is apparently the following:—

The Asurs were the first settlers in the country, which is now called Chōṭā Nāgpur; they were living then pretty much in the same way as they do now, viz., chiefly by iron smelting and a little husbandry. It may be that a section of them had acquired some civilization

<sup>3</sup> When they are found to practise demonworship, it is only in aid to the deity of the village in the precincts of which they live. In these cases the baigā or priest of the respective community (Korwā or Uṛāon) is making the sacrifice.

and that those remnants of copper mines, found in some localities of Chōṭā Nāgpur owe their origin to this advanced section of the Asurs. The Muṇḍāris entered Chōṭā Nāgpur after them, coming from the West, leaving the Korkus in the Ellichpur District and other Kolarian tribes in other parts of the Central Provinces. Doubtless a fierce struggle between the new comers and the original settlers ensued, in which the Asurs, perhaps in a bloody battle were almost annihilated, the surviving remnant being driven to the hills, where we find them even now; however the spirits of the slain haunted the victors who being horrified by the tremendous slaughter they had committed among their enemies, for ever feared that these spirits would take revenge and hence the deifying and worship and propitiation of them by means of sacrifices on the part of the conquerors. The Asurs have most probably adopted the language of the latter, the Muṇḍāris, retaining only part of their original "duk mā" and making such alterations in the pronunciation of the language of their conquerors as suited them best. By and bye they added also Dravidian words to their vocabulary and still later on some Hindi words and thus was made up the present Asur Dukmā, of which on the following pages a grammatical outline is given.

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## CHAPTER I. TRANSLITERATION.

1. *Vowels.*

Short *a* and long *ā* like the final *a* in the word *America* and the *a* in *father*, respectively :—

- short like the *e* in the English word *glen* ;
- long, as the *a* in *rate* ;
- *i* and *ī* as *i*, in *bit* and *ee*, in *tree* respectively ;
- short like the *o* in *short* ;
- long as in *both* ;
- *o* a sound similar to the *oa* in *broad* ;
- *u* short and long *ū* as in *full* and *flute* respectively ;
- *au* diphthong like *ou* in *house* ;
- *ai* resembling the *i* in *light*.

2. *Hiatus and Consonants.*

The check which often occurs after a vowel and especially when two vowels stand together, is represented by an apostrophe ('). The semivowels *y* and *v* are frequently employed in connection with short vowels for the sake of euphony.

Little is to be said with regard to consonants, since they are the same as in the Hindi alphabet, with which the reader is supposed to be familiar; the guttural nasal *n* is represented by a ruled  $n = \underline{n}$ . The nasal *n* in connection with the guttural *g* is represented by *ṅ*. The palatial *d* and *t* are written *ḍ* and *ṭ* and the cerebral  $r = r$ , *c* is pronounced like *ch* in *church* *ch* is its aspirated form.

## CHAPTER II. NOUNS.

3. *Gender and Number.*

The *Asur dukmā* does not distinguish between gender. Whenever it is desired to distinguish sex, the *Asur* adds with regard to children, *kōrā* and *kūrī* to *hōpon*, respectively, thus *kōrā hōpon*, means a male child, and *kūrī hōpon*, a female child. For irrational beings he makes use of the word *saṅḍī* and *eyā* ; e.g., *kūl* = tiger, *kūl saṅḍī* = male tiger ; *kūl eyā* = tigress.

*Asur* has three numbers, the Singular, the Dual, and the Plural. The formation of the latter two is quite easy ; for the Dual simply adds *kiṅ* and the Plural *kū* ; thus :—

<i>hōr</i> , a man ; <i>hōr kiṅ</i> , two men ; <i>hōr kū</i> , men ; <i>īpil</i> , a star ; <i>īpil kiṅ</i> , two stars ; <i>īpil kū</i> , stars ;		<i>haḍḍā</i> , an ox ; <i>haḍḍā kiṅ</i> , two oxen ; <i>haḍḍā kū</i> , oxen ; <i>dīrī</i> , a stone ; <i>dīrī kiṅ</i> , two stones ; <i>dīrī kū</i> , stones ;
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4. *Cases.*

The Nominative, Accusative and Dative have no case signs and are therefore alike; when however in the Dative direction is implied it takes the sign of the Ablative case *tē*. The sign of the genitive is *ā* and *rā* and that of the corresponding possessive *ren* and *renī*.

The Locative sign is *rē*, the vocative is identical with the nominative and is preceded by the interjection *oe*; therefore

Nominative	} are the same.
Accusative	
Vocative	
Dative	
Dative, II form	} <i>tē</i> .
Ablative	
Genit. <i>ā</i> , <i>rā</i> .	
Possess. <i>ren</i> , <i>renī</i> .	
Loc. <i>rē</i> .	

5. *Case examples.*

Nominative, Accusative, and Dative :

*niā dīri idanā*, this is a stone.

*minā dīri aguimē*, bring that stone.

*hor kū vedkanā*, the men have come.

*hor kū alopē rūepē*, don't beat the men.

*kūl mīad hadḡā hablidīde*, the tiger has seized an ox.

*Asur hor ku ōt kākū kameā*, the Asurs do not cultivate the field, *hukū merhed kameā*, they work iron.

*Sadom idimē*, take away the horse.

*sadom bir ovaie mē*, give grass to the horse.

Dative and Ablative :

*Jū, hunī tē senōmē!* Go up to him.

*Jū, amā vatu te senōmē* Go to your village.

*iḡ orā tē rūar tanāiḡ* I am returning home.

Ablative and Instrumental :

*Am okoāḡē vejulenā?* Where do you come from?

*Banai banai hor kū raḡet tē gojoyanā.* Many people died from starvation.

*Honā vatu tē iḡ vedlenā.* I came from that village.

*minīetē paisā rejemē!* Take away the money from him!

Genitive and Possessive :

*iḡā orā*, my house; *aleā orā*, our house.

*amā nyumū citanā*, what's your name?

*hinirā gendrā aguime*, bring his cloth.

*sadom rā caulom*, the tail of the horse.

*sūtam rā bāver*, a rope of cotton.

*meṛhed rā kaṭu*, a sword of iron.

*neā disum ren rājā*, the king of this country.

*neā oṛā rēni hoṛkū*, the men of this house.

*boyoy rēni hopon*, this is my younger uncle's son.

*Asur rēni Baigā kuniā*, the Asurs have no priests, *lit.* of the Asurs no priest is.

**Locative :**

*oṛā re*, in the house.

*okoārē dōhótanā ?* Where (in what) do you stay ?

*mini rē dāri konoā*, he has no strength (in him).

*Burū rā usul rē*, on the top of the hill.

*otē latar rē*, underneath the earth.

**6. Declination of the noun.**

*hopon*, child.

*Singular.*

Nom. <i>hopon</i>	the child.
Gen. <i>hopon rā</i> or <i>hopon ren, reni</i>	of the child.
Dat. <i>hopon</i> or <i>hopon tē</i>	to the child.
Acc. <i>hopon</i>	the child.
Abl. <i>hopon tē</i>	from or by the child.
Loc. <i>hopon rē</i>	in or on the child.
Voc. <i>oē hopon</i>	oh child.

*Dual.*

Nom. <i>hoponkiṅ</i>	the two children.
Gen. <i>hoponkiṅ rā</i> or <i>ren, reni</i>	of the two children.
Dat. <i>hoponkiṅ</i> or <i>tē</i>	to the two children.
Acc. <i>hoponkiṅ</i>	the two children.
Abl. <i>hoponkiṅ tē</i>	from or by the two children.
Loc. <i>hoponkiṅ rē</i>	in or on the two children.
Voc. <i>oē hoponkiṅ</i>	oh ye two children !

*Plural.*

Nom. <i>hoponkū</i>	the children.
Gen. <i>hoponkū rā</i> or <i>ren</i>	of the children.
Dat. <i>hoponkū</i> or <i>tē</i>	to the children.
Acc. <i>hoponkū</i>	the children.
Abl. <i>hoponkū tē</i>	from or by the children.
Loc. <i>hoponkū rē</i>	in or on the children. ,
Voc. <i>oē hoponkū</i>	oh children.

## CHAPTER III. ADJECTIVES.

7. *General remarks on adjectives.*

Adjectives are subject to no change whatever, they are in reality nouns and are therefore declinable.

*hinī buggī hor īdanā*, he is a good man.

*nihi sadom hetkan īdanā*, this horse is bad.

*nihi maṇḍī sibil koneā*, this meal is not savoury.

*Asur horḥu hudīy īdanāḥkū*, the Asurs are a small people.

*Ranchī rē banā Gomkekū īdanāḥkū*, at Ranchi there are many Sahebs.

*Usul burū*, the high mountain.

Adjectives are formed from nouns by adding the past participle ending of the verb, e.g., *napā*, health, *napākan*, healthy. Verbal adjectives are formed in the same way; example: *rūvā*, to be beaten, *rūvākan*, beaten; *huni napākan hor īdanā*, he is a healthy man. *Hukū rūvākan mudaiḥkū īdanāḥkū*, they are beaten enemies.

8. *Comparison of adjectives.*

The degrees of comparison are expressed in the same manner, we find in Hindī and the Kolarian languages, viz., the word compared stands in the nominative and the word with which it is to be compared, is placed in the Ablative case, thus:—

*Iṅā ṛrā amā ṛrā tē baḍeā*, my house is larger than your's.

*Sadom tē hāthī dāriā*, the elephant is stronger than the horse.

*Iṅā seṅot sanamkū tē usulai*, my daughter is the tallest (taller than all).

## CHAPTER IV. PRONOUNS.

9. *Personal pronouns.*

<i>Singular.</i>	<i>Dual.</i>	<i>Plural.</i>
1. <i>Iṅ, I.</i>	<i>aliṅ, we two.</i>	<i>alē, we.</i>
2. <i>am, thou.</i>	<i>akṅ, I and you two.</i>	<i>abū, we and you.</i>
	<i>aban, you two.</i>	<i>apē, you.</i>
	<i>akiṅ, they two.</i>	

From the above it will be seen that in the Dual and the Plural there are two forms of the second person, the first excluding and the second including the speaker. On the other hand the third person is wanting and the demonstrative pronoun is used instead.

10. *Declination of the first person singular.*

Nom. <i>Iḡ</i>	I.
Gen. <i>iḡā</i> or <i>iḡrenī</i>	of me, my, mine.
Dat. <i>iḡ</i> or <i>iḡ etē</i>	to me.
Acc. <i>iḡ</i>	me.
Abl. <i>iḡ tē</i> or <i>iḡ etē</i>	from or by me.
Loc. <i>iḡ rē</i>	in me.

*Dual, first person.*

Nom. <i>aliḡ</i>	we two.
<i>alay</i>	I and you two.
Gen. <i>aliḡā</i> or <i>rā, renī</i>	of us two, our.
<i>alayā</i> or <i>rā, renī</i>	of me and you two.
Dat. <i>aliḡ</i> or <i>aliḡ tē</i>	to us two.
<i>alay</i> or <i>alay tē</i>	to me and you two.
Acc. <i>aliḡ</i>	us two.
<i>alay</i>	me and you two.
Abl. <i>aliḡ tē</i>	from us two.
<i>alay tē</i>	from me and you two.
Loc. <i>aliḡ rē</i>	in us two.
<i>alay rē</i>	in me and you two.

*Plural, first person.*

Nom. <i>Alē</i>	we.
<i>abū</i>	we all, addressees included.
Gen. <i>alēā</i> or <i>rā</i> or <i>renī</i>	of us, our.
<i>abūā</i> or <i>rā</i> or <i>renī</i>	of us all, our      do.
Dat. <i>alē</i> or <i>tē</i>	to us.
<i>abū</i> or <i>tē</i>	to us all      do.
Acc. <i>alē</i>	us.
<i>abū</i>	us all      do.
Abl. <i>alē tē</i>	from us.
<i>abū tē</i>	from us all      do.
Loc. <i>alē rē</i>	in us.
<i>abū rē</i>	in us all      do.

11. *Second person singular.*

Nom. <i>am</i>	thou.
Gen. <i>amā</i> or <i>amrā</i> or <i>amrenī</i>	of thee, thy, thine.
Dat. <i>amā</i> or <i>amētē</i>	to thee.
Acc. <i>am</i>	thee.
Abl. <i>amā tē</i> or <i>amētē</i>	from or by thee.
Loc. <i>amā rē</i>	in thee.

*Dual, second person.*

Nom. <i>aban</i>	you two.
Gen. <i>abanā, abanrā, reni</i>	of you two.
Dat. <i>aban, aban tē</i>	to you two.
Acc. <i>aban</i>	you two.
Abl. <i>aban tē</i>	from you two.
Loc. <i>abran rē</i>	in you two.

*Plural, second person.*

Nom. <i>apē</i>	you.
Gen. <i>apēā, rā, reni</i>	of you.
Dat. <i>apē</i> or <i>apēātē</i>	to you.
Acc. <i>apē</i>	you.
Abl. <i>apēātē</i>	from you.
Loc. <i>apē rē</i>	in you.

12. *Demonstrative pronouns.*

Proximate: *hini*, this, he, she, it; also *mini*.

remote: *huni*, that, he, she, it; also *munī*.

proximate: *nihī, nia, neu, minā*, this, it.

They are used both for rational and irrational beings.

Proximate: *hikū, nikū*, these; *hikiy*, these two.

remote: *hukū, nukū*, those; *hukiṭy*, those two.

13. *Declination of the demonstrative pronoun.*

Gen. <i>hiniā, rā, reni</i>	of him, his, her, of this;
„ <i>huniā, rā, reni</i>	of him, his, her, of that;
„ <i>nihā, neā, nerā, nihereni</i>	of this, of that;
„ <i>hikūā, rā, rēni</i>	of these, of them, their;
„ <i>hukūā, rā, reni</i>	of those, of them, their;
„ <i>hikiyā, rā, reni</i>	of these two, their;
„ <i>hukiṭyā, rā, reni</i>	of those two, their;
Acc. and Dat. <i>hini tē</i> , etc.	to him, from him;
Loc. <i>huni rē</i>	in him.

14. *Examples on the use of pronouns.*

*iṭā aḍḍē vejumē*, come to me (my place come);

*amā ḍrā okoā rē?* Where is thy house?

*hiniā sētā aguimē*, bring his dog;

*nihā sadom okoerā idanā?* To whom belongs this horse?

*nihī hor ovaimē*, give to this man;

*huni Asur kunia*, he is no Asur;

*mini dukmā kāṣ tuanā*, he can't speak the language;

*minā citan vatu?* Which village is this?

*hikūrā sadom nyelēmē*, look after their horse.

*hukurā meromkū kūr hablidiaē*, their goats were destroyed by the tiger.

*nukin hor reni kūrī horkin okoā rē*, where are the wives of those two men ?

### 15. *Relative pronouns.*

There appear to be no relative pronouns. The Asur simply relates the facts as they occurred and does not care to combine them in any way ; thus the sentence : The man died who came yesterday, he will simply render by relating first that the man came and then that he died : *Hor vedyanā huni godyonā*, *lit.* man came, that died.

### 16. *Interrogative pronouns.*

These are *okoe* who, which, what ;

*oko* which, what ;

*citan* which, what ; also *okin*, how.

The declination is regular :

*okoe rā, reni* ; *okoe ti* ; *okoe rē* ;

*okoe vedlenā*, who came ?

*okoe tē vejuyanā*, where did you come from ?

*okoe nyelkedā*, who saw it ?

*am citan koeyanā*, what do you want ?

These pronouns are used also of course as pronominal adjectives, in which case they retain their form : *okoe kūrī vejuyanā* ? What woman was coming ? *Huni oko orā rē dohótanā* ? In which house is he staying ? *Okin sajiyā* ? How far will it be ?

When the question is put to somebody, whether he should like to do such and such a thing, *ci kā* is generally added to the question ; e.g., Will you buy this ? *Niā tilaiyā ci kā* ? Is there water and fuel at your village ? *Amā vatū rē da'ā idanā ci kā* ? *ci kā* meaning "or not." Where we however would use in a sentence "or not" it is expressed in Asur by *ci konā* or *kuniā*, e.g., Will you obey my order or not ? *Ijā dukmā sariyā ci konā* ? Do you know (can you speak) Hindi or not ? *Am Sadān dukmā dāriā ci konā* ?

### 17. *Indefinite pronouns.*

For the indefinite pronouns "anyone" and "anything" the demonstrative pronouns *okoe* and *okō* are used, besides *okō* for "any" and "some" :

*Orā rē okoe idanā* ? Is there anybody at home ?

*Okā hetā hejomē*, come at any time.

*Okā okā helā kūr hejuā*, sometimes the tiger comes.

“Something” and “anything” is also expressed by *citan* :

*Amā citanā idanā* ? Have you anything ? (*lit.* of thee, thine anything is) ?

18. *List of names of relatives.*

There is also in Asur the curious method of combining the *pronomen possessivum* with the names of parents, children and relatives in general. As the Asur *dukamā* is rather rich in these names, a list of the principal is given below :—

<i>Iḡā āpuiḡ</i>	my father.
„ <i>hālāḡ</i>	„ grand-father.
„ <i>huniḡ</i>	„ elder brother.
„ <i>duiḡ</i>	„ elder sister.
„ <i>gungumiḡ</i>	„ father's brother.
„ <i>hāloniḡ</i>	„ father's sister.
„ <i>hoponiḡ</i>	„ son.
„ <i>huḡiḡ</i>	„ grand-son.
„ <i>teḡamiḡ</i>	„ son-in-law.
„ <i>huhḡiḡ</i>	„ brother-in-law.
„ <i>eḡāiḡ</i>	„ mother.
„ <i>jīaḡ</i>	„ grand-mother.
„ <i>boyoḡ</i>	„ younger brother.
„ <i>bokkōniḡ</i>	„ younger sister.
„ <i>hiliḡ</i>	„ mother's brother.
„ <i>daimiḡ</i>	„ mother's sister.
„ <i>teḡotiḡ</i>	„ daughter.
„ <i>katiḡ</i>	„ grand-daughter.
„ <i>kūriḡ</i>	„ daughter-in-law.
„ <i>iyadiḡ</i>	„ sister-in-law.

CHAPTER V. ON THE VERB.

19. *On tense characteristics.*

The Asur *dukamā* has strictly speaking only 4 tenses : the present, the imperfect, the past or perfect, and the future.

The present tense active and neuter voice add *tunā* or *ā* to the root : *nyeltanā*, I am seeing ; *druptanā*, I am sitting ; *idan-ā* (*idanā*), I am being ; and *yanā* and *tadā* for the indefinite : *botoyanā*, it is hot ; *rabayyanā*, it is cold ; *sentadā*, I go ; *jomtadā*, I eat.

The imperfect of transitive verbs adds to the root *lidiā*, *lidiā*, *lā* ; that of intransitive verbs adds *lenā* and *yanā* : *senlenā*, I was going ; *dohólenā*, I was remaining ; *dukāmlidiā*, was speaking ; *ovāldiā*, was giving.



The perfect adds to the root the following tense characteristics : *ā, kedā, ked, ledā, ya, yanā, kan, kanā* : *jomkedā*, I have eaten; *vejukanā*, I have come; *senyanā*, have gone; *duk māyanā*, have been called.

The future adds *eā, eyā* or *yā* and in some words *nā* : *senēā*, I shall go; *duk māyā*, shall speak; *ragēyā*, shall call; *rūēā*, shall beat.

With regard to the future tense it must be observed, that the Asur will never employ the present, as is done in English, when in reality the future is meant; for example "Can you do this?" or "Do you know this?" must be rendered by using the future tense: *Nihī kameyā?* *Nihī tuanā?* "I go home this year." *Neā mēs rē ōrā tē senōain, lit.* this year in house to I will go.

#### 20. On participles.

The adverbial participle adds *rē* to the root of the verb: *nyūe rē godyanā*, he died drinking, in the act of drinking.

In the present participle the stem is repeated and then *tē* is added: *jomjomtē*, eating; *nyel nyel tē*, seeing.

The past perfect participle adds *kan* and *tē* to the root: *jomkante*, having eaten; also *len*, e.g., *senlen tē jomeā*, having gone, I will eat; *vejkantē*, having come.

The conjunctive participle adds *ked tē* and *tē* to the root of the verb: *jomked tē* after having eaten; *nyeltē*, after having seen.

#### 21. On the infinitive and conditional.

The infinitive adds *ta'ā* to the root of the verb: *nyuta'ā*, to drink; *drupta'ā*, to sit; *nyelta'ā*, to see; *jomtu'ā*, to eat.

The conditional adds *rē* together with the particle *dō* which is similar to the Hindī "tō," e.g., *iyā sen rēdō bēseyā*, if I go, it will be well; *huni vejā rēdō nelēyā*, if he had come, he would have seen; *iy rūrēdo*, if I beat; *bugē lekā tē kāmē rē dō-amā pairā yameā*, if you work well, you will receive money; *tē* also is used for the conditional, e.g., *amā tuāetē iy rageyā*, if I knew thee, I would have called thee *lit.* from knowing thee I shall call thee.

#### 22. On the passive voice.

Little is to be said with regard to the passive voice. For the present tense *oā* or *vā* is added to the root: *rūvātlanā*, I am beaten. In the past tense it is *rūvāyanā*, I was beaten; and in the future *vā* or *goā* is simply added to the root instead of *eā* in the active and neuter verb: *rūgoā*, I shall be beaten.

#### 23. General remarks.

The noun of agency is formed by adding *ae* to the root, which is repeated: *jomjomaē*, eater; *rūrūae*, beater. Nouns are formed from

the verb by dropping the ending of the infinitive: *dukṃāta'ā*, to speak; *dukṃā*, speech; *jojṃm*, food, from *jomta'ā*, to eat is an exception.

In conjugation the pronominal termination of the subject is added to the inflectional ending of the verb, but this principle is not so universally applied in the Asur Dukmā as for example in the Mundari language.

24. *Conjugation of the verb : rūta'a, to beat.*

Present tense : I beat or I am beating.

Sing.	1.	<i>ij rūtanā</i> or <i>rūtanaij</i>	I am beating.
	2.	<i>am rūtanā</i> or <i>rūtanam</i>	thou art beating.
	3.	<i>huni rūtanā</i> or <i>rūtanāe</i>	he, she, it is beating.
Dual.	1.	<i>aij rūtanā</i> or <i>rūtanālij</i>	we two are beating.
	1 + 2.	<i>abaj rūtanā</i> or <i>rūtanālay</i>	I and you two are beating.
	2.	<i>aban rūtanā</i> or <i>rūtanāban</i>	you two are beating.
	3.	<i>akij rūtanā</i> or <i>rūtanākiy</i>	they two are beating.
Plur.	1.	<i>alē rūtanā</i> or <i>rūtanālē</i>	we are beating.
	1 + 2.	<i>abū rūtanā</i> or <i>rūtanābū</i>	we and you are beating.
	2.	<i>apē rūtanā</i> or <i>rūtanāpē</i>	you are beating.
	3.	<i>hukū rūtanā</i> or <i>rūtanākū</i>	they are beating.

25. *Imperfect tense : I beat or was beating.*

Sing.	1.	<i>ij rūlidiā</i> or <i>rūlidiāij</i>	I was beating.
	2.	<i>am rūlidiā</i> or <i>rūlidiām</i>	thou wast beating.
	3.	<i>huni rūlidiā</i> or <i>rūlidiāe</i>	he was beating.
Dual.	1.	<i>aij rūlidiā</i> or <i>rūlidiālij</i>	we two were beating.
	1 + 2.	<i>alay rūlidiā</i> or <i>rūlidiālay</i>	I and you two were beating.
	2.	<i>aban rūlidiā</i> or <i>rūlidiāban</i>	you two were beating.
	3.	<i>akij rūlidiā</i> or <i>rūlidiākiy</i>	they two were beating.
Plur.	1.	<i>alē rūlidiā</i> or <i>rūlidiālē</i>	we were beating.
	1 + 2.	<i>abū rūlidiā</i> or <i>rūlidiābū</i>	we and you were beating.
	2.	<i>apē rūlidiā</i> or <i>rūlidiāpē</i>	you were beating.
	3.	<i>hukū rūlidiā</i> or <i>rūlidiākū</i>	they were beating.

The imperfect may be formed also with the auxiliary *dohótanā*, *ij rū dohókedaij*, etc.

26. *Perfect tense : I have beaten.*

Sing.	1.	<i>ij rūkedā</i> or <i>rūkedāij</i>	I have beaten.
	2.	<i>am rūkedā</i> or <i>rūkedām</i>	thou hast beaten.
	3.	<i>huni rūkedā</i> or <i>rūkedāe</i>	he has beaten.
Dual.	1.	<i>aij rūkedā</i> or <i>rūkedālij</i>	we two have beaten.
	1 + 2.	<i>alay rūkedā</i> or <i>rūkedālay</i>	I and you two have beaten.
	2.	<i>aban rūkedā</i> or <i>rūkedāban</i>	you two have beaten.
	3.	<i>akij rūkedā</i> or <i>rūkedākiy</i>	they two have beaten.

Plur. 1.	<i>alē rūkedā</i> or <i>rūkedālē</i>	we have beaten.
1 + 2.	<i>abū rūkedā</i> or <i>rūkedābū</i>	we and you have beaten.
2.	<i>apē rūkedā</i> or <i>rūkedāpē</i>	you have beaten.
3.	<i>hukū rūkedā</i> or <i>rūkedākū</i>	they have beaten.

27. *Future tense: I shall beat.*

Sing. 1.	<i>iḡ rūeyā</i> or <i>rūeyāiḡ</i>	I shall beat.
2.	<i>am rūeyā</i> or <i>rūeyām</i>	thou wilt beat.
3.	<i>hunī rūeyā</i> or <i>rūeyāe</i>	he will beat.
Dual. 1.	<i>aliḡ rūeyā</i> or <i>rūeyāliḡ</i>	we two shall beat.
1 + 2.	<i>alay rūeyā</i> or <i>rūeyāliḡ</i>	we and you two shall beat.
2.	<i>aban rūeyā</i> or <i>rūeyāban</i>	you two will beat.
3.	<i>akiḡ rūeyā</i> or <i>rūeyākiḡ</i>	they two will beat.
Plur. 1.	<i>alē rūeyā</i> or <i>rūeyālē</i>	we shall beat.
1 + 2.	<i>abū rūeyā</i> or <i>rūeyābū</i>	we and you shall beat.
2.	<i>apē rūeyā</i> or <i>rūeyāpē</i>	you will beat.
3.	<i>hukū rūeyā</i> or <i>rūeyākū</i>	they will beat.

The past future is formed with the help of the auxiliary *cabta'ā*:  
*iḡ rūcabe'aiḡ*, I shall or will have beaten.

28. *Conjugation of the conditional.*

Sing. 1.	<i>iḡ rūrēdō</i> or <i>rūrēdoiḡ</i>	if I beat.
2.	<i>am rūrēdō</i> or <i>rūrēdōam</i>	if thou beat.
3.	<i>hunī rūrēdō</i> or <i>rūrēdōae</i>	if he beat.
Dual. 1.	<i>aliḡ rūrēdō</i> or <i>rūrēdōaliḡ</i>	if we two beat.
2.	<i>aban rūrēdō</i> or <i>rūrēdōaban</i>	if you two beat.
3.	<i>akiḡ rūrēdō</i> or <i>rūrēdōakiḡ</i>	if they two beat.
Plur. 1.	<i>alē rūrēdō</i> or <i>rūrēdōalē</i>	if we beat.
2.	<i>apē rūrēdō</i> or <i>rūrēdōapē</i>	if you beat.
3.	<i>hukū rūrēdō</i> or <i>rūrēdōkū</i>	if they beat.

29. *Conjugation of Passive present: I am beaten or being beaten.*

<i>iḡ rūvātānā</i> or <i>rūvātānāiḡ</i>	I am beaten.
<i>am rūvātānā</i> or <i>rūvātānām</i>	thou art beaten.
<i>hunī rūvātānā</i> or <i>rūvātānāe</i>	he is beaten.
<i>alē rūvātānā</i> or <i>rūvātānālē</i>	we are beaten, etc.

Past: I was beaten.

<i>iḡ rūvāyanā</i> or <i>rūvāyanāiḡ</i>	I was beaten.
<i>am rūvāyanā</i> or <i>rūvāyanām</i>	thou wast beaten.
<i>aliḡ rūvāyanā</i> or <i>rūvāyanāliḡ</i>	we two were beaten.
<i>alē rūvāyanā</i> or <i>rūvāyanālē</i>	we were beaten.
<i>hukū rūvāyanā</i> or <i>rūvāyanākū</i>	they were beaten.

Future: I shall be beaten.

<i>ij rūgoā</i> or <i>rūgoāij</i>	I shall be beaten.
<i>aliy rūgoā</i> or <i>rūgoālij</i>	we two shall be beaten.
<i>alē rūgoā</i> or <i>rūgoālē</i>	we shall be beaten.

### 30. *The potential.*

For the potential mood *kā* is added to the modified stem of the verb.

Sing.	<i>ij rūēkā</i> or <i>rāēkāij</i>	I may beat.
	<i>am rūēkā</i> or <i>rūēkāam</i>	thou mayst beat.
	<i>hunī rūēkā</i> or <i>rūēkāe</i>	he may beat.
Dual.	<i>aliy rūēkā</i> or <i>rūēkālij</i>	we two may beat.
	<i>aban rūēkā</i> or <i>rūēkāaban</i>	you two may beat.
	<i>akiy rūēkā</i> or <i>rūēkākiy</i>	they two may beat.
Plur.	<i>alē rūēkā</i> or <i>rūēkālē</i>	we may beat.
	<i>apē rūēkā</i> or <i>rūēkāpē</i>	you may beat.
	<i>hukū rūēkā</i> or <i>rūēkākū</i>	they may beat.

The verb *tuainā*, "knowing" is frequently used in the sense of a potential; e.g.,

<i>ij seneā tuainā</i>	I will be able to go;
<i>ij kaiy seneā tuainā</i>	I will be unable to go.
<i>Hunī dukmā kāe tuainā</i>	he cannot speak Asur.

It is used also as a permissive:

*ij jib jom tuainā*, I can, *i.e.*, I am permitted to eat meat.

### 31. *The Imperative.*

The imperative is the same as in *Muṇḍāri*, with this difference that for the sake of euphony the imperative endings *mā* and *pē* and *kā* are often preceded by the vowel *e*.

Sing.	2. <i>rūemē</i>	beat thou or <i>am rūemē</i> .
	3. <i>rūēkāe</i>	may he beat.
Dual.	2. <i>rūēban</i>	you two beat.
	3. <i>rūēkākiy</i>	may they two beat.
Plur.	2. <i>rūēpē</i> or <i>apē rūēpē</i>	you beat.
	3. <i>rūēkākū</i>	may they beat.

## CHAPTER VII. NEGATIVES, COMPOUNDS, CAUSALS, ETC.

### 32. *Verbs with the negative.*

There are in the *Asur dukmā* three negatives which can be connected with any verb, *viz.*, *kā*, not; *alōkā*, may not and *alō*, do not.

<i>kāij rūēāij</i> or <i>ij kā rūēāij</i>	I will not beat.
<i>kām rūēām</i> or <i>am kā rūām</i>	thou will not beat.
<i>kāe rūēāe</i> or <i>hunī kā rūēāe</i>	he will not beat.

<i>Alōkuiṅ rūḍaiṅ or rūḍgō</i>	I may not beat.
<i>alōkam rūḍam or rūḍgō</i>	thou mayst not beat.
<i>alōkāe rūḍāe or rūḍgō</i>	he may not beat.
<i>alom rūḍmē</i>	do not beat, (thou).
<i>alōpē rūḍpē</i>	do not beat, (you).

*kā* is often employed in the sense of "not" in connection with adjectives; e.g., *kā pariḷā*, not good, i.e., bad, *kā* answers therefore our usual negative prefix *un*.

### 33. *Examples of verbs combined with negatives.*

<i>iṅ kāiṅ jomtānāiṅ</i>	I do not eat.
<i>am kām jomtanām</i>	thou dost not eat.
<i>apē kāpē jomtanāpē</i>	you do not eat.
<i>iṅ kāiṅ senā</i>	I will not go.
<i>āle kāle senā</i>	they will not go.
<i>āpe kāpe senā</i>	you will not go.
<i>alōkāiṅ senā</i>	I may not go.
<i>alōkākū senā</i>	they may not go.
<i>alom jommē</i>	do not eat.
<i>alōkāhū jomeḥ</i>	do not let them eat.
<i>alōkāe vejā</i>	do not let him come.
<i>alom senōāe</i>	do not let go.

### 34. *Agreement of the verb with its object.*

The curious peculiarity of making the active verb to agree with its object, found in the Kolarian languages, is also met with in Asur; for example :

<i>huni kulkiṅḍe</i>	he sent me.
<i>huni kulkeḍmeḍe</i>	he sent thee.
<i>huni kulkeḍiā</i>	he sent him.
<i>iṅḍ alom rūiṅmē</i>	do not beat me.
<i>huni alom rūiemē</i>	do not beat him.
<i>aiṅ rūkiṅ pē</i>	beat them (two).
<i>huni kulkeḍkūḍe</i>	he sent them.
<i>ovāiṅmē</i>	give me.
<i>ovālemē</i>	give us.
<i>dukḡāetanāiṅ</i>	I am saying to him.
<i>huni dukḡākūtānāe</i>	he says to them.

### 35. *Compound verbs.*

Compound verbs are frequently used in the Asur dukmā; a noun followed by the verb *dohōteā*, to be, to remain; e.g. :

<i>iṅ hāsu dohōtanā</i>	I am ill; lit. I pain remain
<i>huni hāsu dohōtanāe</i>	he is ill.

<i>iṅ hāsu dohólenā</i> or <i>dohólenaiṅ</i>	I was ill.
<i>am hāsu dohólenā</i> or <i>dohólenam</i>	thou wast ill.
<i>alē hāsu dohókedalē</i>	we were ill.
<i>hukū hasu dohókedākū</i>	they were ill.
<i>raṅet'</i> , hunger : <i>raṅet'yanaṅ</i>	I was hungry, poor ; <i>lit.</i> I hunger was.
<i>rabay</i> , cold : <i>rabaytanā</i>	it is cold.
<i>lōlō</i> , hot or heat, <i>lōlō tanaṅ</i>	I feel hot.
<i>iṅ raṅet dohóeyaiṅ</i>	I shall be hungry.

There are many verbs combined with the word *rúar*, back; which is conjugated regularly.

Sen <i>rúaryanaṅ</i>	I returned.
<i>apē sen ruarpē</i>	come ye back, return,
<i>hukū dukmā rúarkedākū</i>	they replied, answered.

### 36. Causal verbs

are formed by the insertion of the particle *gē* between the root of the verb and its termination; example :

<i>iṅ druptanāiṅ</i>	I am sitting.
<i>iṅ drupgētanaṅ</i>	I make to sit.
<i>nyuemē</i> , drink ! <i>nyūyegēmē</i>	make to drink !
<i>jommē</i> , eat ! <i>jomgēmē</i>	feed !
<i>nirēmē</i> , run ! <i>niregēmē</i>	cause to run !

Causals of course are formed also by different words :

*hukāyēme*, hide; intr. *horogēme*, hide; trans. *gitiṅēmē*, sleep; intr. *konyonemē*, make to sleep; *raputeā*, to break; intr. *raputendemē*, break; trans. *giṅēmē*, cut; trans. *magēmē*, make to cut.

The completive is *cabā* : *Hunī jomcabāyanā*, he has finished eating; *hukū rúcabākedākū*, they have ceased beating.

### 37. Defective verbs

“*tanā*” is only used as inflectional ending in the verb of the present tense, meaning “to be” “*idanā*” to be, as a rule is likewise employed only in the present tense sing. and plur. It is often employed where we use the verb to have : *amā aḍḍē paisā idanū?* have you money? *lit.* is there money with you?

<i>apē cimin hor idanā</i>	how many men are you ?
<i>amā hoponku idanā</i>	have you children ?

The verb used to make good for the want of the auxiliary verb to be is *dohóta'ā*, to remain; which is used also in the present tense.

<i>iy Asur dohótanāiy</i>	I am an Asur.
<i>iy hāsu dohólenā</i>	I was ill.
<i>iy rū dohókedā</i>	I was beating.

In fact it is with the help of *dohóta'ā* that those tenses may be made up in Asur which otherwise are wanting.

### 38. *The verb : not to be.*

The counterpart of *īdanā* is *konoā* and *konā*, not to be: *iy Asur kuniā*, I am not an Asur. *Kuniā*, not to be present: *Sāheb kuniā*, the Saheb is not present. *Kuneā*, will not be present. *Amā haḍḍā idanā ci konoā*, have you oxen or not? *Orā rē okoe idanā ci konoā?* Is there somebody at home or not? *Okoe kuniā*, there is nobody (man) present. *Iyā aḍḍē paisā konā*, I have no money; *lit.* with me there is no pice.

## CHAPTER VIII. ADVERBS.

### 39. *Adverbs of time.*

<i>enan</i>	just now.
<i>nahā</i>	now.
<i>niho</i>	then.
<i>bārhiy</i>	now-a-days.
<i>okā helā</i>	sometimes.
<i>tihiy</i>	to-day.
<i>holā</i>	yesterday.
<i>gapā</i>	to-morrow.
<i>musiy</i>	one day.
<i>bārsiy</i>	two days.
<i>nēs</i>	this year.
<i>hon kalom</i>	last year.
<i>baggī</i>	time.
<i>orte rē</i>	once, one time.
<i>auri</i>	not yet.

### 40. *Adverbs of place and manner.*

<i>nenē, nendē</i>	here.
<i>honhon rē</i>	beyond.
<i>nenētē</i>	from here.
<i>hondē</i>	there, thither.
<i>okoārē, okoā tē</i>	where, whither.
<i>hinad rē, himā</i>	near.
<i>saṅiy</i>	far.
<i>bekar ; kudahā</i>	very ; very much.

<i>nimin, nimin rē</i>	this many, much.
<i>hinā rē</i>	namely.
<i>numun, numun rē</i>	thus.
<i>nūi lekā tē</i>	in this way.
<i>oko lekā tē</i>	somehow, anyhow.
<i>thaukā</i>	well, exactly.
<i>rokē, rokē rokē</i>	quickly.

41. *Adverbs of affirmation and negation.*

<i>ā</i>	yes.
<i>kozn, kuan</i>	no, not.
<i>gē</i>	indeed, certainly.
<i>alō</i>	do not.

42. *Elliptical sentences.*

Of these the following may be mentioned with the adverbs, *viz.*, *ebā*, come here; *dolū*, come along; *itū*, who knows.

<i>Gitanā ci lekā!</i>	What can be done!
<i>Gitan ciliyanā?</i>	What or how do you do?
<i>jojom tē</i>	right hand.
<i>lengā tē</i>	left hand.

CHAPTER IX. NUMERALS, POSTPOSITIONS, CONJUNCTIONS AND INTERJECTIONS.

43. *A. Numerals (Cardinals).*

The Asur can only count up to four.

<i>mīad</i>	one.
<i>bariā</i>	two.
<i>pēā</i>	three.
<i>upun</i>	four,

which are used for all genders: *pēā horkū*, three men; *pēā hadḍā*, three oxen.

For the rest the Asur employs Hindi numerals; for twenty *kūri* is used: *mīad kūri*, one score.

44. *B. Ordinals.*

The Asur *dukumā* has only three ordinals, *viz.*:

<i>sidā</i>	first.
<i>e!ā</i>	second.
<i>mandē</i>	third.

For single *ōḥay*; for both *bannar* is used.

<i>sanam</i>	all.
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45. *Postposition 5.*

<i>maray rē</i>	in front, before.
<i>taijom rē</i>	after, near.
<i>usul rē</i>	on, above.
<i>latur rē, olē rē</i>	under, underneath.
<i>adde, tülē (urāon)</i>	with, by, along with.
<i>gati</i>	together, in company.
<i>minā</i>	inside.
<i>talā re</i>	among.

46. *Conjunctions and Interjections.*

<i>gā, egā</i>	for.
<i>kinā gē</i>	therefore.
<i>nihī ra'atē</i>	for this reason.
<i>niā mentē</i>	for that.
<i>hentē</i>	therefore.
<i>enan—miyan:</i>	when—then.
<i>ci—kā</i>	}:
<i>ci—koan</i>	
<i>nīho</i>	then, thereupon.
<i>hed, oṛō</i>	and.
<i>hed tē</i>	and then, from then, thereupon.
<i>pa'en</i>	but.
<i>hōn</i>	even.

*o'e* in addressing, oh; *kó* is added in calling or shouting. *Asur rā oṛā rē alom bolō kó*, do not enter the house of the Asur. *ju, ju ju!* Go, be off! *kó*, halloh!

## CHAPTER X. THE ASUR DUKMĀ A KOLARIAN DIALECT.

47. *Similarity with Muṇḍārī and Santhālī.*

A glance at the preceding pages will convince the student of Kolarian languages that in the Asur Dukmā we have to deal with a Kolarian dialect pure and simple.

The declination of the noun and pronoun, the conjugation of the verb, the dual number, the manner in which the verb is made to agree with the object, the similarity of the pronouns and numerals as well as of the postpositions and conjunctions, all these characterize the Asur Dukmā as a Kolarian Dialect.

Moreover if I were to prove this fact by a Vocabulary, I might simply take out four-fifths of the Muṇḍārī or Santhālī vocabulary. Yet

there are differences between Asur and other Kolarian languages, peculiarities, which it will be worth while to notice.

#### 48. Differences with *Munḍāri*.

Wherever a *Munḍāri* word begins with the consonant *h*, the Asur has *v*; e.g.:

<i>Munḍāri</i> :	<i>hiju</i> ,	Asur :	<i>veju</i>	come.
„	<i>hātu</i> ,	„	<i>vātū</i>	village.

The Asur is fond of the *y* before vowels as against the *Munḍāri* :

<i>Munḍāri</i>	<i>nel</i> ;	Asur	<i>nyel</i>	see.
„	<i>nutum</i> ;	„	<i>nyumun</i>	name.
„	<i>nam</i> ;	„	<i>yam</i>	to seek, find.

Other differences may be seen from the following words :—

<i>Munḍāri</i> :	<i>hon</i> ;	Asur :	<i>hopon</i>	child.
„	<i>horō</i> ;	„	<i>hor</i>	man.
„	<i>kulā</i> ;	„	<i>kūl</i>	tiger.
„	<i>dub</i> ;	„	<i>drup</i>	sit.
„	<i>reyē</i> ;	„	<i>ranget</i>	hunger.
„	<i>jilū</i> ;	„	<i>jil</i>	flesh.
„	<i>om</i> ;	„	<i>ovat</i>	give.
„	<i>gitil</i> ;	„	<i>bitil</i>	sand.
„	<i>akō</i> ;	„	<i>hukū</i>	they.
„	<i>ko</i> ;	„	<i>kū</i>	plural ending in arms.
„	<i>etkan</i> ;	„	<i>hetkan</i>	bad, evil.
„	<i>ni</i> ;	„	<i>hinī</i>	this (man).
„	<i>neā</i> ;	„	<i>huni</i>	that.
„	<i>ne</i> ;	„	<i>nihi</i>	this.
„	<i>nā</i> ;	„	<i>nahā</i>	now.
„	<i>tisiy</i> ;	„	<i>tihiy</i>	to-day.
„	<i>otē</i> ;	„	<i>ōt</i>	earth, field.
„	<i>hanātiy</i> ;	„	<i>hātiy</i>	portion.
„	<i>nērē, entē</i> ;	„	<i>nēnē, hondē</i>	here, there.
„	<i>aḍeā</i> ;	„	<i>aḍ</i>	lose.
„	<i>apiā</i> ;	„	<i>pēā</i>	three.
„	<i>hēr</i> ;	„	<i>rērē</i>	sow.
„	<i>calom</i> ;	„	<i>caulom</i>	tail.
„	<i>bāyar</i> ;	„	<i>bāver</i>	rope.
„	<i>atom</i> ;	„	<i>hātom</i>	aunt (father's sister).
„	<i>geḍ</i> cut ;	„	<i>geḍ</i>	to slaughter, kill.

The most striking difference between *Munḍāri* and Asur appears to be that the auxiliary verbs are different from each other ; for whilst the former has *menā* to be, the latter has *īdanā* ; and for the negative

“not to be” we find *banōā* and *konoā* respectively, the latter being only found in the Muṇḍāri patois spoken round about Ranchi. Whilst Muṇḍāri has *taikenā* for was or remained, the Asur has *dohōlenā*. Even where words in Asur seem to be identical with the corresponding Muṇḍāri words, there is this difference between them that the Asur uses them in a more general sense, than the Muṇḍā does; e.g., *rū* is in Muṇḍāri to play (beat) the drum, also to beat with a stick; but in Asur it means only to beat, strike; *sārī*, to play; but in Asur it means to rejoice.

#### 49. *Dravidian words in the Asur Dukmā.*

There are doubtless words used in Asur which are Dravidian; however these may have been borrowed from the Orāōns; for example *baigā*, priest is the Orāōn *naigā*; *ēde*, to plant, is the Kurukh *īd*; *eḥā*, second, the Kurukh *eṇḍtā*; *pōtā*, belly the same as *pōtā*; *pa'en*, *pahēn* and *hōn* the emphatic affix are in both languages the same; *eyā*, *īgyō*, mother, are apparently of the same origin; *cohā*, kiss *conhā*, love, in Kurukh; *ortē rē*, once in Asur and *ort* one in Kurukh; *ṭhaukā*, right; *aḍḍē*, place, also *tūlē*, with *ōḷoy*, single. Some of these are met with also in Muṇḍāri and it may be a disputable question whether these words are Dravidian or Kolarian; e.g., *aḍḍē*, *ṭhaukā*, *con* = *conhā*, *eyā*.

#### 50. *Genuine Asur words.*

There are many words in Asur which I am unable to derive either from Muṇḍāri or Kurukh words, for example :

<i>hērē</i>	husks;	<i>hurū</i>	unhusked rice.
<i>lainī</i>	harlot;	<i>anyān</i>	mercy, kindness.
<i>pārīlā</i>	good;	<i>usad</i>	anger.
<i>lilai</i>	distribute;	<i>sodor</i>	arrive, perhaps the seter in Muṇḍāri.
<i>dukmā</i>	speak;	<i>irī</i>	conscience, wise (perhaps
<i>minā</i>	inside;	connected with the Kurukh <i>ērṇā</i> , see.)	
<i>baggī</i>	for time, season;	<i>dohō</i>	remain.
<i>kaṭiṅ</i>	a little;	<i>usul</i>	high.
<i>nāpā</i>	well, healthy;	<i>banāi</i>	many.
<i>teṅōt</i>	daughter;	<i>rohē</i>	quickly.
<i>hili</i>	uncle (mother's brother);	<i>javar</i>	gather.
<i>teyam</i>	son-in-law;	<i>rod</i>	embrace.
<i>hātā</i>	grand-father;	<i>īdanā</i>	to be.
<i>huhī</i>	brother-in-law &	<i>iyad</i>	sister-in-law, etc.
<i>hed</i>	and;	<i>barkīṅ</i>	now-a-days.

<i>jadau</i>	cloth ;	<i>nēs</i>	this year.
<i>hinud</i>	near ;	<i>mande</i>	third.
<i>numun</i>	thus ;	<i>siriṅ</i>	to make merry, which in Santhāl is to sing.

Bir dō roṅōlenā :                   bir geṭer, geter !  
 ṭhaukā bir roṅōlena :               baṛeā bugḡi rē.  
 The grass is burning :               grass knack ! crack !  
 Well is the grass burning :       in spendid beauty.

(One of the very few songs of the Asurs.)



*An Inscription of the time of Kapilēndra Dēva of Orissa, from Gōpināthapura, District Cuttack. (With an Appendix on the last Hindu Kings of Orissa.)—By BABU MON MOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.*

[Read April, 1899.]

This inscription comes from the village Gōpināthapura in District Cuttack, Orissa. The village is 13 miles N. E. of the town Kaṭaka, and stands on the Birūpā branch of the river Mahānadi. Its position would be about  $20^{\circ} 31'$  Lat. and  $86^{\circ} 4'$  long. The inscription is on a stone slab attached to the eastern gate of a middle sized temple of Jagannātha. It commemorates the erection of that temple and of the companion temple of Guṇḍicā, where the cars used to be driven to at the time of the great Ratha festival. Both the temples now lie dilapidated, and the car-festival is no longer held.

The stone slab containing the inscription is about  $3'3'' \times 2'6'' \times 6''$ . I edit the inscription from two inked estampages not very well done. The inscription is peculiar at least in one respect. The language is Sanskrit, but the characters are Oṛiyā. As yet this appears to be the earliest known inscription of such a kind.

To begin with, the characters generally resemble the modern Oṛiyā letters. Small differences are observable in ca, ja, ḍa, ta, dha, bha, ra, la, ha, and ya, the differences being mainly in the terminal loop. The letter ṭa is still in Kuṭila type. The vowel marks do not differ. The conjunct consonants often differ, in several instances approaching the modern Bengali conjuncts, such as those of ṅ (in ṅka, ṅga), those of y (in sya, dya), those of v (in dhva). The letters are fairly legible, except in the middle and in some of the lower lines. They vary in size, those in the first line being  $1'' \times \frac{1}{2}''$ , in the last line  $1\frac{1}{3}'' \times \frac{3}{4}''$ , and elsewhere varying from  $\frac{1}{2}'' \times \frac{1}{2}''$  to  $\frac{3}{4}'' \times \frac{3}{4}''$ . The lines do not run straight, but in a slipshodly curved way.

The orthography presents no great peculiarity. The *halanta* is generally conjuncted with the initial consonant of the next word (*cf.* ls. 6, 9 and 11); the guttural ṅ is sometimes represented by anusvāra

(*saṅga*, *raṅga* l. 8, *bhaṅgi* l. 20), and sometimes by ण (*niḥṣaṅkaḥ*, *paṅka*, l. 4); the palatal ñ is represented always by anusvāra (*caṁcala* l. 1, *Kāṁcihara* l. 17); the dental n is sometimes represented by anusvāra (*vamḍinān* l. 10); the avagraha is sometimes omitted *kālē(')rpitā* l. 6, *prasannō(')stu* l. 30.

The inscription takes up thirty lines. The language is of the later inflated style. Excepting the invocation and a short passage in line 29, it is entirely in verse, 27 stanzas of various metres. It was composed by Jāgali Kavi, and was inscribed by one Vakākhyā. Many verses show elegance and rhetorical skill.

According to the inscription, the temple of Jaganātha at Gōpināthapura was built under the orders of Gōpinātha Mahāpātra, the minister of the king Kapilendra *alias* Kapilēṣvara Dēva of Orissa. The inscription mentions Gōpinātha's genealogy as follows :—

**Lakṣmaṇa Mahāpātra,**<sup>1</sup>

priest of the king  
Kapilendra (l. 11).

Elder son, **Nārāyaṇa**,  
a minister of the  
same king (l. 12).

Younger son,  
**Gōpinātha Mahāpātra**, (l. 13)  
of the Hārīta Kula (l. 20)

|  
**Jāgali** (l. 29),  
born of Gōpinātha.

The inscription mentions **Kapilendra** also as **Kapilēṣvara** (l. 17), and describes him as belonging to the solar line (l. 5) with the title **Bhramaravara** (l. 7). **Kapilendra** is said to have defeated and caused terror in the hearts of the kings of **Karṇāṭa**, **Kalavaraga**, **Mālava**, **Gauḍa** and **Dhilli** (l. 7, cf. also lines 16 to 19). **Gōpinātha** is described as having assisted his master materially in the various conquests and to have led an invasion into **Mālavēndra's** territory, crossing many hills (l. 19).

The inscription is undated, but its time can be approximately ascertained. **Gōpinātha's** father and elder brother having previously served the same King, **Gōpinātha** must have taken service in the latter part of the king's reign. Then again the inroad to **Mālava** in line 19, verse 16, is apparently identifiable with the invasion of the Orissa

<sup>1</sup> **Lakṣmaṇa Mahāpātra**, the donor's father is mentioned in another Oriyā inscription as the "*purōhita*" or priest of **Kapilēṣvara Dēva**; cf. my article, Journ. As. Soc. Beng., Vol. LXII, 1893, pp. 91-2.

king into Bidar. This invasion is timed by Ferishta as 1461 A.D.<sup>1</sup> After that some time must have elapsed before the new temple was erected. Hence the date of the inscription might approximately be put at 1465 A.D.

The temple contains the images of Jagannātha, Balarāma and Bhagavati Subhadrā (l. 22, v. 19). It was endowed with gardens, dancing girls, ornaments and servants, &c., (l. 24, v. 21). A Guṇḍicā temple was also built in accompaniment (l. 26, v. 23).

TEXT.<sup>2</sup>

1. 1. Ōm namaḥ Ṣṛi-Puruṣōttamāya Ṇ  
Maulau cam(ñ)cala-cūlini tilakini bhālē mukhē hāsini kaṇṭhē  
mauktika-mālini malayajaiḥ praty-angam = ālēpini | hastā-  
v(b)jē navanitini caraṇayōḥ kṛi—
1. 2. -dā-rasān = narttini jiyāc = chaṣava-ṣōbhini cid-amalā Gōpāngan-  
āliṅgini Ṇ [1]  
Samsār-ārṇava-karṇa-dhāram = api tam bhakt-ārtha-samsāri-  
ṇam vandē Ṣṛi-Puruṣōttamam tanu-bhṛtām saṅkalpa-kalpa-  
drumam | vēdānt-ārtham = udāhara—
1. 3. -nti khalu yaṁ yēn = ākhilam bhāsātē hr̥ṣṭē yatra hr̥ṇiyatē padam  
= api svāyambhuvanā dēhinām Ṇ [2]  
Sadyaḥ piyūṣa-pātō manasi nayanayōḥ kāma-cintā durantā  
ṣāntā kaṣṭam vinaṣṭam janir = ajani sati lav(b)dha—
1. 4. -m = iṣṭam yathēṣṭam | pāpā-kūpāra-pāram gatam = api pitarō  
dhvasta-v(b)andh-ānuv(b)andhā (yēnā) = lōki trilōka-nilaya-  
maṇir = ayam nila-ṣail-āvataṁsaḥ Ṇ [3]  
Nihṣaṅkaḥ paṅka-magn-ākhila-dharaṇi-ta—
1. 5. -l-ōddhāra-bhū-dāra-simhaḥ svacchandam Mlēccha-vṛndaṁ prati  
jagati Kalēr = ādya-bhāgē = pi Kalki | bhāsvad-vaṁṣ-āvata-  
aṁsas = tri-jagad-adhipater = nila-ṣail-ādhināthasy = ādēṣād =  
Ōdra-dēṣē samaja—
1. 6. -ni Kapilēndr-ābhidhānō narēndrah Ṇ [4]  
Sadā-tulita-yat-tulā-puruṣa-dāna-kālē = rpitān = trilōka-vijayā-  
rjitān = kanaka-parvatān = sarvataḥ | vinidram = animēṣ aṇam  
diviṣadaṣ = ciram rakṣitum mila—
1. 7. -nti kanak-ācalē vijayinō = sya dāna-bhramāt Ṇ [5]  
Karṇāt-ōjjhāsa-simhaḥ Kalavaraga-jayi Mālava-dhvaṁsalilā-  
jaṁghālō Gauḍa-mardi Bhramaravara-nṛpō dhvasta-ḍhill Ī-  
ndra-garvah | saṁgrāmē dra—

<sup>1</sup> Elphinstone's History of India, Ed. 1874, Appendix, p. 755.

<sup>2</sup> From two ink impressions.

1. 8. -ṣṭum = ṣnam pratibhaṭa-subhaṭāḥ kēvalan = tē valantē yēṣām  
 syān = nāka-nāri-kuca-kalaṣa-taṭi-kunjkum-āṅk-[ ā ]mga-raṁ-  
 gaḥ || [6]  
 Yasy = ōccair = vāji-rāji-vikaṭa-khurapuṭ-ōdghāṭita-kṣauṇi-  
 prṣṭha-prādurbhūta-prabhūta—
1. 9. -kṣiti-kaṇa-nikarair = lakṣyamāṇē prayānē | garjad-gambhira-  
 bhēri-bhara-rava-vibhav-ākarṇi-karṇā vivarnā murcālāḥ  
 kṣauṇi-pālāḥ sapadi samabhavan = kānan-āntē = py = anantē || [7]  
 Caṇḍē kō—
1. 10. -daṇḍa-duṇḍē sakṛd = api samarē yasya saṁsakta-kāṇḍē sam-  
 varttē sampravṛttē gatahati vilayaṁ vairi-jālē karālē | vam(n)-  
 dinām krandinīnām nayana-ghana-ghan-ā(ō)tsādyamānair =  
 amānair = durvārair = vāri-vārāih pratipada-muditō
1. 11. -bhinna-mudraḥ samudraḥ || [8]  
 Tasy = āpta-haṁsaḥ sa hi haṁsa-vaṁṣa-kētōḥ purōdhā ma-  
 khakṛd-vatamsaḥ | vidvān = Mahāpātra-kul-āvataṁsaḥ **Ṣri-**  
**Lakṣmaṇō** = bhūt = prathita-praṣaṁsaḥ || [9]  
 Mantri-ṣṛēṇi-ṣirōmaṇi(ṇi)ḥ sa(su)manasaḥ santāna-cintā—
1. 12. -maṇiḥ pāpa-vrāja-ṣiṣ-augha-gāruḍa-maṇiḥ sad-vṛtta-rakṣā-  
 maṇiḥ | padm-ōllāsa-vilāsa-vāsara-maṇiḥ putrō ṣ sya Nārā-  
 yaṇaḥ satr-ārambha-parāyaṇō ṣ jani jana-trāṇāya Nārāyaṇaḥ ||  
 || [10]  
 Yasy = āsīd = anu—
1. 13. -jō mataḥ kṣiti-bhujām **Ṣri-Gōpināthō Mahāpātraḥ** pātra-jan-  
 ārcan-aika-rasikaḥ pātraṁ guṇānām mahat | ṣri-kāntas =  
 tanayaṁ kṛtāntam = aryaṣ = cintāmaṇim mārgaṇā rājānaḥ  
 sura-mantriṇaṁ vidur = amum kā—
1. 14. -ntāṣ-ca kāntam ratōḥ || [11]  
 Rājēndrād = adhigamya ṣōḍaṣa vara-cchattrāṇi citrāṇy = asau  
 durgēṣu prayatēṣu ṣōḍaṣa mitēṣv = āsīd = aram nāyakaḥ |  
 va(ba)n-dikṛtya raṇēṣu ṣōḍaṣa nṛpāndrō(mṣ = c = o?)pāharat =  
 svāminē
1. 15. varṣē gacchati ṣōḍaṣē svayam = abhūn = mantri-indra śkaḥ  
 punaḥ || [12]  
 Manyē pūrvam = apūrvva-kirttir = asakṛvid-dvij-āhavē pārthivān  
 = kāruṇy-ākālitā(tō) nutā(n\*) pa(pra)ti-bha(blu)vō(vām)dēvo  
 ṣ bhūd = Bhārgavaḥ | v(b)andi-kṛtya narē—
1. 16. -ndra-maṇḍalam = ayam yad(yō) = Ga(Gō) pinātha-cchalāt = sadyaḥ  
 samprati mum(ṇ)cat = iha vitaran svām svām pratiṣṭhām  
 punaḥ || [13]  
 Kṛtvā saṁyati Mālav-ēndra-jayinam sēn-ādhinātham tu yaṁ  
 Gauḍ-ēndrasya nitāntam = Utkala-patha-prasthāna-rōdh-ā—



1. 17. -rgalam | **Ḡri-Khaṇḍ-ādri-payō-dhar-ōpari-karam** nirmāya **Kām-(N)ci-harah** sānandaṁ **Kapilēḡvarō** viharatē **Karṇāṭa-rāja-criyā** || [14]  
 Cētō-vṛttir = iv = ātmanaḥ suvimalā lōkē = dhikā kirttidā sthir-āçaya-riti-vad = gṇa-ma—
1. 18. -ṇi-çrēṇi = va vistāriṇi | sam(sa)nmārg-ānugatā ca santatir = iva prāyēṇa sautāpinām santāp-ōnmathanā kṛpāvad = amunā khātā ca khāt-āvali || [15]  
 Garv-augham **Gurjarēndrah** pariharati-tarām = āçu **Ḑhilli-Narēndrah** sāndrām ta—
1. 19. -ndrām = avindat = kuṇapa-gatim = agād = **Gauḍa-bhūmi-mah-ēndrah** | bhū-blṛn-mālām karālām pathi pathi militām ram-(ha\*)s = ōllanghya sēnā-nāthē **Ḡri-Gōpināthē** paribhara(va)ti ca tām **Mālav-ēndrasya** gu (?) tām (?) || [16]  
 Prāsāda—
1. 20. -m = ētam nayan-ābhirāmam vyadhata **Hārītakul-āv(b)hī-candraḥ** | asāra-samsāra-gabhīra-paṅka-niḡçaṅka-niḡkrānty-avalamv(b)a-daṇḡam || [17]  
 Jiyāt-prāsāda-cūḡā-maṇi-rama-ramaṇēḡ prānta-samsakta-bham-(ṇ)gī bham(ṇ)ga-prāgbhāra-vi(bi)mv(b)a-sphuṭa—
1. 21. -ghaṭita-vṛ(bṛ)hat-manthanī maṇḡalikaḥ | uttānam nyasta-mūrtiḡ prathita-sad-amṛta-prāptik-ārthō bhav-āv(b)dhērugrajō(?) -dam(ñ)cad-ūrmī pracaya-bhaya-bhuvō = mantha-manthāna-daṇḡam || [18]  
 Rāmam **Ḡri-Puruḡottamam** Bhagavatim = asmin = Su—
1. 22. -bhadrām tathā ratn-ālam(ṇ)kṛti-rāji-rājita-tanum bhaktyā =yam = asthāpayat | bhāty = ēḡam tritayam navam tri-jagati-cintāmaṇinām trayam prāsā (dē\*) ca samudgakē vinihitam kim madhyamē piṣṭapē || [19]  
 Sauvarṇa-çruti-pāṇi-pā—
1. 23. -da-lṛdayō haima-prabhā-maṇḡalē bhāsvan-maṇḡala-samṇibhē maṇi-lasat-tulā-sarōj-āsanaḥ | sō s yam hāra-kiriṭa-kuṇḡala-dharaḥ samskāra-dhāri sadā dhyēyā(yaḥ) svarṇa-may-ākṛtim pathi dṛṣōr = nirmāti Nārāyaṇaḥ || [20]  
 Udyānā—
1. 24. -ni navāni mālya-vidhayē kartum tri-kāl-ārccanam bhōgān svarga-purōcitān = upacitān rāmāç = ca Rambh-ōpamāḥ | nānā-ratna-vibhuṣaṇāni bahuçō vāsāmsi bhūyāmsy = asau prāyacchat -paramēṣṭhiṇē parijanō da (?)
1. 25. -ttēna kim svāminē || [21]  
 Pakṣatvam tvayi yāty-ayam dvija-patiḡ pakṣ-ōnnataç = c = ābhav-  
 vat Kams-ārē s sya samasta-vāsanam-abhūt = khyātō ha mē ca

- dr̥ṣṭṣṭ | Dr̥ṣṭṣṭ ṣ smion = adhip-ādhikāra-yugalē kāmē gatiḥ sam-  
prati = ty = ākhyāt = tam Garuḍaḥ
1. 26. kṛt-ām(ñ)jalir = asau papha (?) purō vartatṣ || [22]  
Yēn = ākāri prasāri-dyuti-rajata-çatām Guṇḍio-āgāram = Īçō  
yasmin = Kailāsa-vāsa-praṇayam = adhigatō = hanta dēçṣ ṣ py =  
amuṣmin | yasya prāgbhāra-khaṇḍa-sthala-vikala-nabhō—
1. 27. -maṇḍal-ājasra-liṇḍaḥ-mārttā(ta)ṇḍā(ṇḍa)ç = ca pracaṇḍa-çrama-  
çamana-paṭur = mmaṇḍapē ṣ bhūd = akhaṇḍaḥ || [23]  
Svādhyāy-ābhlyāsa-ghōṣair = mukharita-gaganē yajña-yūp-āvali-  
bhīr = bhūyah samçōbhamānē dvija-vara-gahanē çōbhanē çāsanē  
ṣ smi—
1. 28. -n | āvairam ca prapam(ñ)cam Naraka-ripur = ayam Kāmapālah  
Subhadrā grām-éçasy = āparēçām = api bhavatu sadā maṅgalā  
gō-jalāya || [24]  
Prahād-Ōddhava-Pārthānām bhaktānām viraha-vyathām |  
tyājītō Gōpināthēna puṇḍarika-vilōcanaḥ || [25]
1. 29. Mimānsakasya nigam-ānta-vicāra-pāra-samçārīṇō ṣ sya kavi-  
paṇḍita-Gōpināthāt | jātasya Jāgali-kavō raman-ōktir = ēçā  
harç-ōnnatim sumanasām sarasām tanōtu || ⊙ || [26]  
Çubham = astu || **Vakākhyēna** likhitam |
1. 30. Çri-Gōpināthaḥ prasaunō = stu siddhidō bhakta-vatsalah | Guṇa-  
ratn-ākaraḥ çrimān = **Kapilendra**-hṛdi-sthitaḥ ||

*Abstract of contents.*

The inscription begins with a salutation to God Puruṣōttama. Verses 1 to 3 invoke His blessings. By order of the God enthroned on the blue hill (i.e., Jagannātha), the king named Kapilendra appeared in the Odra kingdom as an ornament of the solar line (v. 4). His constant gifts at the sacred places tempted even the gods to come down (v. 5). The king, surnamed Bhramaravara, conquered Karṇāṭa, Kalavaraga (Kulbargā), Mālava and Gauḍa, and destroyed the pride of the Delhi king (v. 6). His march was indicated by the huge dust raised by the hoofs of his high horses, and the loud sounds of his bugles frightened the other kings and made them fly to forests (v. 7). The arrows of his bow put to death his enemies, the tears of whose imprisoned ladies removed the land-barrier of the sea (v. 8). He had a faithful priest named Lakṣmaṇa Mahāpātra, an ornament of the Mahāpātra Kula (v. 9). Lakṣmaṇa's son was Nārāyaṇa, the head of the ministers (v. 10). Nārāyaṇa's younger brother was Gōpinātha Mahāpātra, who was favoured by the king, and was in possession of the best qualities (v. 11). He got from the king sixteen umbrellas, took sixteen forts, imprisoned in war sixteen

chiefs, and after sixteen years became the chief minister (v. 12). Methinks Paraçurāma in the guise of Gōpinātha conquered anew the circle of kings, but unlike his previous act, replaced each king in his territory (v. 13). Having made him the Commander-in-Chief, him who defeated the Mālava king, and who stood as a bar to the inroad of the Gauḍa king, the monarch Kapilēçvara enjoyed the Çri of Karnāṭn, levied taxes over the Khaṇḍa hill, and carried the Kāñci city by force (v. 14). He (Gōpinātha) dug tanks by the side of roads, clear watered, well-known, calm, wide and cool (v. 15). The Commander-in-Chief Gōpinātha having crossed the terrible mountains on the way, and having conquered the Mālava king, the Gurjara king gave up his pride, the Delhi king felt dejected, and the Gauḍa king turned mean like a çavara (v. 16). The moon of the Hārīta line (Gopinātha) erected this fine temple as a staff for deliverance from the mires of this unsubstantial world (v. 17). The temple is the highest with the solar *maṇḍala* as its finials, and serves as a staff for churning nectar (the meaning not clear throughout) (v. 18). In this temple he placed Rāma (Balarāma), Puruṣōttama (Jagannātha), and Bhagavati Subhadrā, fully ornamented (v. 19). The Nārāyaṇa was made as described in the *dhyāna* (hymn)—then follows a description of his ornaments (v. 20). For garlands new gardens, *bhōgus* fit for heaven, maidens (charming) as Rambhā, many jewelled ornaments, ample dresses, he gave to the deities—what more shall be said about the servants given? (v. 21). “Oh Lord! May this Garuḍa be your steed.” On his (Gōpinātha’s) saying this as if Garuḍa himself stood in front with hands clasped and wings spread (meaning throughout not clear) (v. 22). By him was raised a Guṇḍicā temple, bright and silver white, where Mahādēva felt the delights of Kailāça mountain, and on whose cloud-dividing top the sun rested (v. 23). In this Çāsana resounding with Vedic teachings, decked with numerous sacrificial posts and crowded with high class Brahmins, may Jagannātha, Balarāma and Subhadrā bring good to the village lord, the residents, (the village) cattle and (its) water! (v. 24). By consecrating this Viṣṇu, Gōpinātha removed pangs of separation from the hearts of devotees like Prahlāda, Uddhava and Pārtha (*i.e.*, Arjuna) (v. 25). May these charming verses of the Mimāṃsaka Vaidāntika poet Jāgali, born of the poet and the learned Gōpinātha, increase the delight of the wise! (v. 25). May it be good! Written by Vakākhyā. May Gōpinātha (*i.e.*, Viṣṇu) beloved of Lakṣmī, meditated by the King Kapilēndra, fond of his devotees, fulfiller of desires, and like sea in qualities, may He be gracious (unto us)! (v. 27).

## APPENDIX.

## THE LAST HINDU KINGS OF ORISSA.

In the Gōpināthapura Inscription the King Kapilendra Dēva is described as of the Solar line “bhāsvad-vam̃ṣ-āvntam̃ṣa(h\*).” Very little authentic is known about these kings of Orissa. The time has now come to throw light into this dark chapter, and to give some account of them based on inscriptions supplemented at places by the Mādaḷā Pāñji and other records.

## A. SŪRYA VAM̃ṢA DYNASTY.

(5 KINGS).

I. KAPILĒNDRA *alias* KAPILĒṢVARA DĒVA, BHARAMAVARA.

(1434–35 A.D.—1469–70 A.D.)

Up to date the undermentioned authentic dates of this King—the founder of the Solar line—have been found<sup>1</sup> :—

No.	Dates.	References.
1.	4th Aṅka, Dhanu New moon,	Left side Inscription No. 3 of the Jagan-
(O.)	Sunday = 9th December, 1436	nātha temple [J.A.S.B., Vol. LXII, 1893,
	A.D.	pp. 92–3].
2.	4th Aṅka, Kumbha (?) Çukla	The temple of Mukhalingēçvara at Mukha-
(O.)	13, Monday = 18th February,	lingam, District Gañjām [Dr. Hultzsch's
	1437 A.D.	Epigraphical Report for 1895–6, No. 141,
		p. 14]. I am indebted to Dr. Hultzsch
		for an ink impression of this old Oṛiyā
		inscription.
3.	4th Aṅka, Mithuna Saṅkrānti	Right side Inscription No. 2 of the Bhu-
(O.)	Kṛṣṇa 1, Tuesday = 29th May,	vanēçvara temple [J.A.S.B., Vol. LXII, pp.
	1437 A.D.	103–4].
4.	19th Aṅka, Tulā Kṛṣṇa 2, Sun-	Right side Inscription No. 1 of the Bhu-
(O.)	day = 2nd November, 1449	vanēçvara temple [J.A.S.B., Vol. LXII,
	A.D.	p. 10–3].
		<i>N.B.</i> —The <i>purnimānta</i> scheme has been used
		here, instead of the usual <i>amānta</i> scheme.
5.	19th Aṅka, Mēṣa New moon,	Right side Inscription No. 2 of the Jagan-
(O.)	Sunday = 12th April, 1450	nātha temple [J.A.S.B., Vol. LXII, 1893,
	A.D.	p. 99].
6.	Çaka 1373, Māgha Çukla 5,	The Oṛi-Kūrmaṅ temple (near Çikāḷā),
(S. & T.)	Thursday, Jovian year Prajā-	20th pillar, east and north face inscription
	pati = 27th January, 1452	[Dr. Hultzsch's Epigraphical Report for
	A.D.	1895–6, p. 20, Nos. 317 and 318; and my
		Ms. transcript].

<sup>1</sup> O. Signifies Oṛiyā in language, S. Sanskrit, and T. Telugu.

No.	Dates.	References.
7.	25th Aṅka, Çaka 1377, Bhā-	The Çri-Kūrmam̄ temple, 18th pillar, west
(T.)	drapada] Çukla 3, Saturday	face inscription [Dr. Hultzsch's Ep. Rep.,
	= 26th August, 1455 A.D.	1895-6, p. 20, No. 318; and my Ms.].
8.	Çaka 1377, Bhādrapada moon-	Copper-plate inscription of the king Gāna-
(S.)	eclipse (?), the year Yuvan	Dēva of Kōṇḍa-vidu [Dr. Hultzsch, Ind.
	= August (?), 1455 A.D.	Ant., Vol. XX, p. 391].
9.	1461 A.D.	... Ferishta, l. c. Elphinstone's History of India,
		Appendix, p. 755; and Sewell's sketch of
		the dynasties of Southern India, p. 23.
10.	32nd (33rd) Aṅka, Çaka 1382,	The Çri-Kurman̄ temple, 18th pillar, west
(T.)	Jyēṣṭha Va 5 (? 7), Monday,	face inscription [Dr. Hultzsch's Ep. Rep.,
	the year Vikrama = 12th May,	1895-6, p. 19, No. 284; and my Ms.].
	1461 A.D.	
11.	35th (37th) Aṅka, Mēṣa Kṛṣṇa 4,	Left side Inscription No. 5 of the Jagan-
(O.)	Wednesday = 25th April, 1464	nātha temple [J.A.S.B., Vol. LXII, pp.
	A.D.	95-6].
12.	Circa 1465 A.D.	... The present inscription of the Gōpīnātha-
(S.)		pura temple.
13.	41st Aṅka, Dhanu Çukla 7, Left side	Inscription No. 4 of the Jagan-
(O.)	Sunday = 14th December,	nātha temple [J.A.S.B., Vol. LXII, pp.
	1466 A.D.	93-4].

From the Aṅka inscriptions, Kapilēçvara's accession year can be ascertained as follows:—

4th Aṅka or 3rd year	= 1436-7 A.D.
19th Aṅka or 16th year	= 1449-50 A.D.
25th Aṅka or 21st year	= 1454-5 A.D.
33rd Aṅka or 27th year	= 1460-61 A.D.
37th Aṅka or 30th year	= 1463-4 A.D.
41st Aṅka or 33rd year	= 1466-7 A.D.
* * * The 2nd Aṅka or 1st year	= 1434-5 A.D.

According to Aṅka calculations, the last Aṅka of Kapilēçvara and the second Aṅka of his successor Puruṣōttama should fall in the same year. Hence Kapilēçvara's death took place in 1469-70 A.D.<sup>1</sup>

Narasimha Dēva IV. of the Gaṅga dynasty was reigning in 1397 A.D. [J.A.S.B., Vol. LXIV, 1895, p. 133]. The thirty-seven years intervening between this date and the accession of Kapilēçvara Dēva in 1434-5

<sup>1</sup> According to the Mādaḷā Pāñji or the Chronicles of the temple of Jagan-nātha, the king ascended the throne at Camp Kṛttivāsa (Bhuvanēçvara) on Wednesday, Kakaṛā 2, Çu 4; and died on the banks of the Kṛṣṇa-Vēnyā river (the Kṛṣṇā) on Paṅṣa Kṛ. 3, Tuesday. Neither of the dates comes out correct with the week day mentioned.

A.D. are at present epigraphically blank<sup>1</sup>. If the Mādaḷā Pāñji is to be believed, Kapilēçvara succeeded a Bhānu Dēva, whose name (surname?) was, according to one version, Akaṭā-Abatā, and according to another, Matta (drunk). Among the later Gaᅅgas, the usual succession was a Narasiᅁha Dēva followed by a Bhānu Dēva and so on. The thirty-seven years intervening will allow either of only one Bhānu Dēva after Narasiᅁha Dēva IV, or of one Bhānu Dēva followed by a Narasiᅁha Dēva, and then a second Bhānu Dēva. Looking to the rather short period, and the average long reigns of the Eastern Ganga Kings, the first supposition of only one Bhānu Dēva appears more probable.

The accounts given in the Mādaḷā Pāñji show that Kapilēçvara got to the throne probably with the aid of the Bahmanī king (Aᅁmad Shāh I.). The present inscription gives him an *alias*, Kapilendra, and a title Bhramaravara. Gānadēva's Copper-plate inscription speaks of his capital being at Kaṭaka on the bank of the river Mahānadi. He was evidently a powerful King, and extended his dominion from the bank of the Ganges on the north to that of the Kṛṣᅅā on the south. His whole reign was spent in warring with the Hindu Kings of Vijayanagara, or with the Mahomedan Kings of the Bahmanī dynasty, or in suppressing internal revolts. The Mādaḷā Pāñji mentions that he had numerous sons, among whom Puruᅅottama Dēva was one, but not the eldest.

## II. PURUᅅOTTAMA DĒVA.

(1469-70 A.D.—1496-97 A.D.)

The following give all the reliable dates as yet known of this king:—

No.	Dates.	References.
1.	2nd Aᅅka, Mēᅅa Çu 12, Thurs- (O.) day = 12th April, 1470 A.D.	Left side No. 2 Right side No. 1 } Inscriptions of the Jagannātha temple [J.A.S.B., Vol LXII, 1893, pp. 91-2, 98.]
2.	3rd Aᅅka, Çūka 1392, Aᅅviju (T.) Çuddha pratipad, 'Tuesday = 25th September, 1470 A.D.	The Çri-Kūrmaᅁ temple, 49th pillar, north face [Dr. Hultzsch's Epigraphical Report for 1895-6, No. 365, p. 23].
3.	3rd Aᅅka Mārgaᅅira Kṛ. 13, (O.) Tuesday = 28th November, 1470 A.D.	Left side Inscription No. 1 of the Jagan- nātha temple [J.A.S.B., Vol. LXII, pp. 90-1].
4.	Çaka 1393, year Khara, Caitra (T.) Va (? Çu), Ādivāra (Sunday) = 31st March, 1471 A.D.	The Çri-Kūrmaᅁ temple, 49th pillar, west and south faces [Dr. Hultzsch's Ep. Rep., 1895-6, No. 366, p. 23]. (if Va be Çu).

<sup>1</sup> There is an inscription of probably this King in the Çri-Kūrmaᅁ temple (11th pillar, east face) which purports to be dated in 1324 Çaka or 1402-3 A.D. (No. 299, Dr. Hultzsch's Ep. Rep. 1895-6, p. 20). But I have not got the week day and the correct figures yet. Hence it is not taken into consideration.

No.	Dates.	References.
5.	1471 A.D.	Ferishta, l.c., Elphinstone's Hist. of Ind. (1889 ed.), Appendix p. 756; and Sewell's sketch of S. Indian dynasties, p. 23.
6.	7th (4th) Aṅka, Çaka 1393, The Çri-Kürmaṅ temple, 2nd pillar, north (T.) Āsāṛha Çu 2, Thursday, the and west face [Dr. Hultzsch's Ep. Rep., Jovian year Khara = 20th 1895-6, p. 19, No. 274; and my Ms.] June, 1472 A.D.	
6.	7. 1477 A.D.	Ferishta, l.c. Elphin., App. p. 756; and Sewells' sketch, p. 23.
8.	15th (17th) Aṅka, Mēṣa, Di 10 (O.) (11), new moon, Monday, solar eclipse = 7th April, 1483 A.D.	My reading of the Oṛiyā Copper-plate grant to the Balasore Bhuñyās [Ind. Ant., Vol. I, p. 355]. The original reading seems to have been wrong, but Prof. Kielhorn has arrived at the correct English equivalent in Ind. Ant., Vol. XXII, p. 108.
9.	19th Aṅka, Sirḥha Çu 8, Thurs- (O.) day = 18th April, 1485 A.D.	Right side Inscription No. 4 of the Jagan-nātha temple [J.A.S.B., Vol. LXII, 1893, p. 100-1].
10.	Çaka 1411, the Jovian year (T.) Kīlaka = 1488-89 A.D.	A Koṅḍa-Viḍu Inscription [Sewell's sketch south, dyn., p. 48]. The Çaka year <i>current</i> was apparently used.
11.	25th Aṅka, Viṣā (Vṛṣa) Saṅ- (O.) krānti, Çu 8, Thursday = 27th May, 1490 A.D.	Çri-Kürmaṅ temple, 1st pillar (of Nos. 272 and 273), not reported in Ep. Rep. for 1895-6. I am indebted to Dr. Hultzsch's for two ink impressions of this inscription.
12.	Çaka 1417, the Jovian year (T.) Rākṣasa, 32nd (? 33rd) Aṅka, Kārttika Çuddha 13, Mandavāra (Saturday) = 31st October, 1495 A.D.	The Çri-Kurmaṅ temple, 41st pillar, north face inscription [Dr. Hultzsch's Ep. Rep., 1895-6, p. 202, No. 347].

With the help of the Aṅka inscriptions the precise year of Puruṣōttama Dēva's accession can be found out. The Aṅka dates are

2nd Aṅka or 1st year	= 1469-70 A.D.
3rd Aṅka or 2nd year	= 1470-71 A.D.
4th Aṅka or 3rd year	= 1471-2 A.D.
17th Aṅka or 14th year	= 1482-3 A.D.
19th Aṅka or 16th year	= 1484-5 A.D.
25th Aṅka or 21st year	= 1489-90 A.D.
32nd Aṅka or 26th year	= 1494-5 A.D.

\*\*\* The 1st year was 1469-70 A.D.

From his successor's Aṅka dates, the time of Puruṣōttama's death can be deduced. It took place in 1496-97 A.D.

On the death of Kapilēçvara Dēva, his sons fought with one another for the throne. Ultimately Puruṣōttama secured it with the help of the Bahmani king Muḥammad Shāh II. For this aid, he had to cede to the

Bahmani king the southern-most districts of Kōṇḍapalli and Rājāmahēndri. Ferishta calls him "Amber Rai" which is apparently a corruption of the title "Bhramaravara Rāya"—a title still given in Orissa to a prince, not always the eldest one. Later on, the Orissa king appears to have repented of the bargain, and to have attempted a conquest of the ceded districts. This led to an expedition into Orissa in 1477 A.D. by the Bahmani king Muḥammad, which Ferishta reports as having been successful. Anyhow these districts passed ultimately into the hands of the Orissa king, as the Kōṇḍa-Viḍu inscription of 1488-9 A.D. shows.

The king also waged war with Vidyānagara (or as the Mahomedans put it Vijayanagar). *Caitanya-carit-āmṛta*, the well-known biography of the great Bengal Vaiṣṇavite preacher, Caitanya, says that the King Puruṣōttama Dēva conquered Vidyānagara, and thence brought a jewelled *siṃhāsana* (throne) which he presented to Jagannātha, and also the image of *Sākṣi-gōpāla* which he kept in his capital at Kaṭaka (*Çait. car. āmr.*, Madhya Kliaṇḍa, 5th Paricchēda). The first Vidyānagara dynasty was then tottering on its throne, and was shortly after replaced by the second dynasty.

The few details given in the Mādaḷā Pāñji are mainly taken up in describing an expedition of this King into Kāñci. If there be any truth in it, then it is likely connected with the raid of the Bahmani king Muḥammad Shāh II, who in 1477-8 A.D. made a dash towards Conjeeveram, and returned with an immense booty. Puruṣōttama Dēva might have joined the said king as an ally.

According to the Mādaḷā Pāñji this king erected the Bhōga-maṇḍapa (refectory hall) of Jagannātha temple in his 7th Aṅka (1473-4 A.D.); and in his 9th Aṅka (1475-6 A.D.) he built the inner wall and the cooking rooms of that temple.

### III. PRATĀPA RUDRA DĒVA.

(1496-97— ?1539-40 A.D.)

The following dates of this King are known as yet :—

No.	Dates.	References.
1. (O.)	4th Aṅka, Kakṛā Çu 10, Wednesday = 17th July, 1499 A.D.	Left side Inscription No. 6 of the Jagannātha temple [J.A.S.B., Vol. LXII, 1893, pp. 96-7].
2. (O.)	5th Aṅka, Dhanu 3 (?) Kr. (?), Monday = ? December, 1500 A.D.	Left side Inscription No. 7 of the Jagannātha temple [J.A.S.B., Vol. LXII, 1893, p. 97].
3. (T.)	Çaka 1425, the Jovian year Rudhirōdgārīn, Kārttika Çuddha Purnamī, Friday = 1503 A.D., (?) 3rd November.	The Çri-Kūrmaṃ temple, 41st pillar, north face [Dr. Hultzsch's Ep. Rep., 1895-6, p. 22, No. 346].



No.	Dates.	References.
4.	1509–10 A.D. (17th Aṅka of the Mādala Pāñji).	Mahomedan historians, l.c. Hunter's History of Orissa, Vol. II, pp. 9–10, and App. VIII, p. 193.
5.	1510 A.D. (February and March).	<i>Caitanya-carit-āmṛta</i> , beginning of the 7th paricchēda, Madhyama Khaṇḍa; <i>Caitanya-maṅgala</i> , Antya Khaṇḍa, 2nd and 3rd Adhyāya.
6.	1511 A.D., Ratha festival.	<i>Cait.-car.-āmṛ.</i> , Madhya Khaṇḍa, 14th paricchēda; cf. <i>Cait. maṅ.</i> , Antya Khaṇḍa, 5th Adhyāya.
7.	Çaka 1436 = 1514–5 A.D.	Two Inscriptions at Udayagiri [Sewell's sketch of the southern dynasties, p. 48, note 4].
8.	1515–6 A.D.	An Inscription in the Varadarāja-svāmi temple at Conjeveram [Chingleput District Manual, pp. 435–6, l.c., Sewell's sketch south. dyn., p. 119 and p. 48 note 4].
9.	? 1519–20 A.D.	<i>Cait.-car.-āmṛ.</i> , Antya Khaṇḍa, 9th paricchēda.
10.	1522 A.D. (32nd Aṅka of Mādala Pāñji)	Ferishta, l.c., Elphinstone's Hist. Ind., App., p. 760; Hunter's Hist. Orissa, Vol. II, App. VIII, p. 193.

Pratāpa Rudra's accession year falls in 1496–97, as calculated from his only reliable Aṅka date in the Jagannātha temple. The time of his death is uncertain. According to Mādala Pāñji he was succeeded first by his son Kālu-ā Dēva who reigned for a year and five months, and then by another of his sons Kakhāru-ā Dēva who ruled for only three months. They were killed, one after the other, by their minister Gōvinda Vidyādhara. The latter then usurped the throne, and founded the small dynasty known as the *Bhoi*. One inscription of Gōvinda Dēva is known in the temple of Jagannātha. It is dated 4th Aṅka, Bichā Çukla Trtiyā, Tuesday, or 30th October, 1543 A.D. [J.A.S.B., Vol. LXII, 1893, pp. 101–2]. From this it is deducible that Gōvinda Dēva began to reign in 1541–42 A.D. So that if the Mādala Pāñji's dates as regards Kakhāru-ā and Kālu-ā Dēvas be accepted, Pratāpa Rudra's last year would fall in 1539–40 A.D. According to a tradition noticed in the *Jagannātha-carit-āmṛta*, an Oṛiyā biography of Jagannātha Dāsa—a disciple of Caitanya and the founder of the Atibara subsect of Vaiṣṇavas in Orissa—Pratāpa Rudra survived Caitanya. The latter died, according to his biographies, in 1455 Çaka or 1533–4 A.D. So then Pratāpa Rudra might have been reigning at least in 1535 A.D., and there is nothing improbable in his reigning up to 1539–40 A.D.

It was a stirring time. In the north in Bengal, Ḥusain Shāh had been consolidating his kingdom; in the south the Vidyānagara monarchy

was rising again under Narasa of the 2nd dynasty; and a few years later Quṭb Shāh, general of the Bahmani king, founded the kingdom of Gōlkōṇḍā. Pratāpa Rudra, after he had been on the throne for about 5 or 6 years, became engaged in a war with Narasa. Mādālā Pāñji says that he conquered the king; but two Vidyānagara copper-plates, one of Acyuta Rāya and the other of Sadāciva Rāya, speak of Narasa conquering the Gajapati ruler.<sup>1</sup> In 1509 A.D. Ismāil Ghāzi (named Surasthāna in M. Pāñji), a general of the Bengal Nawab, made a dash into Orissa, ravaged the country, sacked Puri town and destroyed a number of Hindu temples. Pratāpa Rudra hurried from the south, and the Mahomedan general retreated. He was closely pursued and defeated on the bank of the Ganges (M. Pāñji). The general took refuge in Fort Māndāran (Subdivision Jehanabad, District Hooghly), and was besieged. But one of the Rājā's high officers, Gōvinda Vidyādharma, went over to the enemy's side; and so the Rājā had to raise the siege and to retire to Orissa. This war and the destruction of the Hindu images have been mentioned in several places in the *Caitanya-maṅgala* *alias Bhāgavata*, one of the earliest biographies of Caitanya the Bengal preacher (composed *circa* 1550-60 A.D.).<sup>2</sup>

It was also a period of considerable religious ferment. Vallabhācārya had begun his religious preachings in the north; and Caitanya began his religious wanderings in Bengal, Orissa and elsewhere. In February 1510 A.D., Caitanya came to Puri and stopped for two months. At that time Pratāpa Rudra had gone to the south, and was fighting with Kṛṣṇa Rāya who had just then come to the throne of Vidyānagara. Wandering in the south after a year Caitanya came back to Puri. There at the time of the Ratha festival the king and the preacher met; and according to the biographies, Pratāpa Rudra was converted and became a devoted disciple.

Several of the king's officers also became Caitanya's disciples, among whom the most prominent was Rāmānanda Rāya, for some time governor of Rājamahēndri. It is related in *Caitanya-carit-āmṛta* (Antya Khaṇḍa, 9th Paricchēda) that Rāmānanda's brother Gōpinātha Barajēnā, who was the revenue officer in charge of Māllyātha Daṇḍapāṭha (at present the eastern part of Midnapur District) fell in arrear of a large revenue—two lakh Kāhāns of cowries, and was ordered by the king to be put to death. He was however saved and reinstated by the mediation of Caitanya's disciples.

<sup>1</sup> Ep. Ind., Vol. III, p. 152; Ep. Ind., Vol. IV, p. 12, "*Viry-ōdagram Turuṣkaṁ Gajapati-nripatiṁ c = āpi jitvā tad-anyaṁ.*"

<sup>2</sup> *Caitanya-maṅgala* *alias Bhāgavata*, Antya Khaṇḍa, 2nd Adhyāya, pp. 772, 779-80; 4th Adhyāya, pp. 865, 866.

In another Vaiṣṇavite work, Jayānanda's *Caitanya-maṅgala*, it is said that Pratāpa Rudra consulted Caitanya about invading Bengal. The preacher dissuaded him, pointing out that the war would be disastrous for Orissa [i.e. the Bengali Magazine *Ṣri-ṣri-Viṣṇupriyā Patrikā*, Kārttik 1897, p. 477].

The latter part of Pratāpa Rudra's reign seems to have been spent chiefly in the south. Kṛṣṇa Rāya, the greatest king of the Vidyānagara second dynasty, invaded the Gajapati territory in 1514-5 A.D., defeated Virabhadra son of Pratāpa Rudra, took prisoner his uncle Tirumalappa Rāya, and conquered all the tract south of the Gōdāvāri. The Vidyānagara generals also made incursions northwards up to Ganjam; and finally Pratāpa Rudra had to make a treaty and to give his daughter in marriage to the victorious monarch.

In 1522 A.D. Pratāpa Rudra waged a long and desultory war with Quṭb Shāh of Gōlkōṇḍā. According to the Mādālā Pāñji neither side gained any decisive victory; but Ferishta says that the Hindu king was defeated, and lost a part of his territory.

#### IV. KĀLU-Ā DĒVA.

(? 1539-40 A.D. — ? 1541-42 A.D.)

Pratāpa Rudra left several sons, and an ambitious and powerful minister, Gōvinda Vidyādharma. The eldest of the sons succeeded under the title Kālu-ā Dēva. No inscription of this king is known. According to the Mādālā Pāñji he ruled for one year, five months and three days. He was murdered by the minister.

#### V. KAKHĀRU-Ā DĒVA.

(? 1541-42 A.D.)

Another son of Pratāpa Rudra succeeded Kālu-ā Dēva under the above title. After a brief and disturbed rule of three months, he, too, was killed by the all-powerful minister. Gōvinda then had the remaining sons of Pratāpa Rudra murdered, and ascended the throne under the title of Gōvinda Dēva. He founded the small *Bhō-i* (writer) dynasty, which with Tēlinga Mukunda Haricandana ruled up to the final Mahomedan conquest of Orissa in 1568 A.D.

#### B. BHŌ-I DYNASTY.

(4 KINGS):

GŌVINDA DĒVA.

(1541-42 A.D.— ? 1549 A.D.)

Only one inscription of this king is known:—

4th Anka, Bichā Çukla 3rd, Tuesday=		Right side Inscription No. 5 of the
30th October, 1543 A.D. (Oriyā).		Jagannātha temple [J.A.S.B.,
		1893, pp. 101-2].

\*\*\* The first year fell in 1541-42 A.D.

According to one version of the M. Pāñji he ruled seven years; according to another version 11 years and seven months. The shorter period is accepted as being more probable. It is more consistent with the reigning years which follow; and as Gōvinda Vidyādhara was in high service in 1509 A.D., he could not be expected to reign long after 1541 A.D. In his 7th Aṅka (1545–46 A.D.) he is said to have waged war with the king of Gōlkōṇḍā. While encamping in the south, his sister's son Raghu Bhañja Chōṭarāya revolted in Orissa. The king hurried back, defeated the rebels who were being assisted by Bengal Mahomedans, and drove them beyond the Ganges.

## II. CAKĀ PRATĀPA DĒVA.

( ? 1549 A.D.— ? 1557 A.D.)

This son of Gōvinda Dēva succeeded. According to one version, he ruled eight years; according to another, twelve years and a half. The shorter period has been accepted. He is represented as a bad king, who oppressed the people.

## III. NARASIMHA RĀYA JĒNĀ.

( ? 1557 A.D. )

According to Mādaḷā Pāñji he had just ascended the throne of his father, when Mukunda Haricandana rebelled and murdered him. He was on the throne for only one month and sixteen days.

## IV. RAGHURĀMA JĒNĀ.

( ? 1557 A.D.— ? 1559–60 A.D.)

The brother of the above succeeded. Mukunda Haricandana continued to revolt, defeated and imprisoned the king's chief minister Danē-i Vidyādhara, defeated and imprisoned Raghu Bhañja Chōṭarāya who had invaded again from the Bengal side, and finally murdered the king, after a disturbed rule of one year, seven months and fourteen days.

## C. TĒLIṄĀ DYNASTY.

(ONE KING).

MUKUNDA DĒVA, HARICANDANA.

(1559–60 A.D.—1568 A.D.)

The last independent Hindu King of Orissa—

The following may be ascribed to his reign:—

1. A. H. 968 = 1560 A.D. ... A silver coin of Jalāl Shah, mint Jājpur [Thomas' Chronicles of the Pathan Kings of Delhi, p. 417].

2. A.H. 973 = 1564–65 A.D. ... Stewart's History of Bengal, ed. 1847, pp. 95–6; Hunter's History of Orissa, Vol. II, p. 12.
3. A.H. 975 = 1568 A.D. (10th Añka of the M. Pāñji). Hunter's Hist. Orissa, Vol. II, page 10. note 29, p. 31; Mr. Beames, J.A.S.B., Vol. LII, p. 233 note.

Mukunda Dēva was a Telugu by birth. He got to the throne by a successful revolt. The silver coin of Jalāl Shāh with the mint mark of Jāipur shows that the Mahomedan king of Bengal assisted in 1560 A.D. Raghu Bhañja Chōṭarāya in his invasion of Orissa, and the coin was struck apparently when on the march to Kaṭaka. Mukunda Dēva however defeated Raghu Bhañja, and imprisoned him. In 1564–65 A.D. the Emperor Akbar sent an ambassador to Orissa, and entered into a treaty with the king. The latter in return sent an ambassador to Delhi. The treaty was intended as a check to the Bengal king Sulaimān Karrarāni. The latter, however, kept quiet, until he found Akbar fully engaged in wars in the west. He then attacked the Orissa king who had come to the banks of the Ganges. Mukunda Dēva took refuge in Fort Kōṭsamā and defended himself therein. Then the Bengal king detached a part of his force, and sent them round to Orissa through Mayūrabhañja and thence southwards by the Kāṣabāsa river. This force under Illāhābād Kālāpahāra began to ravage Orissa, and defeated the king's deputy; while one of the Oṛiyā chiefs raised the standard of revolt. Hearing this the Orissa king hurried south, fought with the rebels and was killed. The rebel chief was in turn killed by the Mahomedans. Raghu Bhañja Chōṭarāya who was lying imprisoned, escaped and attempted to take possession of the throne. After four months' fight with Kālāpahāra, he too was slain; and the Mahomedans took final possession of Orissa. This conquest took place in 1568 A.D.

*An Inscription of the time of Nayapāla Dēva, from the Kṛṣṇa-dvārikā Temple at Gayā.—By BABU MONMOHAN CHAKRAVARTI, M.A., B.L., M.R.A.S.*

[Read April, 1899.]

This inscription is on a stone slab fixed in the right gateway of the Kṛṣṇa-dvārikā temple in Gayā town. The present temple with its image of Kishenji was built 70 or 80 years ago by a Gayāwāl Brahmin, Dāmōdar Lāl Dhōkṛi. But it has been evidently set up on an old site on which had stood a temple containing images of gods Kṛṣṇa and Mahādēva. The inscription was first brought to public notice by General Cunningham, and a facsimile was printed in the Archæological Survey Report of India, Vol. III, Plate XXXII. Dr. Rājēndra Lāl Mitra tried to decipher it, but did not succeed, (see the Proceedings of the Asiatic Society of Bengal, August 1879). I edit the text from two fairly good ink impressions taken by Babu Paramēṣvara Dayāl, Court of Wards' Head Clerk, Gayā. I have had also the advantage of consulting the original in cases of doubtful readings.

The writing consists of 18 lines and covers a space of 2' 4" × 1' 0". The letters are well cut, and where entire are legible. But in many lines the letters are more or less damaged, particularly in the 4th, and 7th to 14th lines. The large number of damaged letters has caused much difficulty in decipherment. In size the letters are  $\frac{3}{10}'' \times \frac{4}{10}''$ . The written characters are of the type known as Kuṭila. The Mātrās (the top horizontal lines) are in full swing; the marks of medial vowels ē and ō are pendent from the top lines as in modern Bēngali and Oṛiyā; and the conjunct consonants including those of ṅ and ñ are carefully engraved.<sup>1</sup>

The inscription is in Sanskrit, and excepting the invocation at the beginning, is in verse throughout. The verses are twenty-one in number and are in various metres. The orthography shows little peculiarity.

<sup>1</sup> These peculiarities I have observed also in another Gayā inscription of the time of Nayapāla Dēva (*Qri-Nayapāla-dēva-nṛpatē rājya-ṣriyam bibhrataḥ* l. 14). This inscription of 15 lines does not appear to have been published yet.

The conjunct consonants are correctly given; the nasals  $\eta$  and  $\tilde{n}$  are generally properly used; with  $\zeta$ ,  $\eta$  is used and not *anusvāra* (as *vaycē* for *vañcē* in line 4, *aṅcu* for *añcu* in line 16); in line 12 one *lupta a* has been shown with  $\tilde{a}$  (*yathārthā s laṅkārah*).

The inscription is a *praçasti* (l. 17) describing the erection of a temple to Lord Jauārdana by a Gayā Brahmin named **Viçvāditya**. The dedicator was a **Mahā-dviija** (l. 4), an euphemistic term for a low class Brahmin who assists in the offering of *piṇḍas*. His genealogy is thus given:—

Paritōṣa (l. 5, v. 5).  
|  
Son  
Çūdraka (l. 6, v. 7).  
|  
Son  
Viçvāditya (l. 8, v. 9).

The *praçasti* was composed by one **Sahadēva**, who was also a *vāji-vaidya* or veterinary physician. The engraving was done by the artisan **Saṭṭa-Sōma** son of **Adhipa-Sōma**.

The historically valuable portion of the inscription is to be found in the last verse. It states that the *praçasti* was written, while **Nayapāla Dēva** was reigning. The year is given as *daça-pañca-saṅkhyā-samvatsarē*, which ordinarily would mean "in the year 510." But unless the year be referred to some unknown era (like *Harṣa* or *Cēdi*), the inscription cannot by any means be referred to so early a date. It seems more reason able to take the expression as *daça* and *pañca*, or the **fifteenth year** of the king **Nayapāla Dēva**.<sup>1</sup>

The **Nayapāla Dēva** of the present inscription is apparently identical with the well known king of that name belonging to the **Pāla** dynasty of **Magadha**, who was the son of **Mahipāla**, and who has been mentioned in several inscriptions. The epigraphical characters and the find-spot of the inscription do not allow of any other identification. The time of this **Nayapāla Dēva** has not yet been precisely ascertained. An approximate idea of his time can, however, be deduced from the *Tibetan Chronicles* compiled by **Rai Çaratendra Dās Bahādur**, in his article on "Indian Pandits in Tibet" (*Journal of the Buddhist Text Society of India*, Vol. I, pp. 7-31). **Ācārya Dipaṅkara Çri-Jñāna alias Atiçā** was a contemporary of **Nayapāla Dēva**, and *Bu-Ston's Chos ḥbyun* gives the following relevant facts. **Atiçā** was residing at **Vajrāsana**

<sup>1</sup> In the other unpublished inscription of **Nayapāla Dēva's** time, the year is distinctly given as fifteen "*Samvrttē taras = aiva pañca-daçame rājyasya samvatsarē*" (l. 14).

(Bōdh Gayā) when the king of the Karṇya in the west invaded Magadha, and a war ensued between him and Nayapāla. The invaders sacked several towns at first, but were ultimately defeated. Atiçā mediated and succeeded in bringing about a treaty between the two kings (p. 9 note). Apparently some time before this he had been appointed by Nayapāla<sup>1</sup> as high priest of the Buddhist Vihāra at Vikramaçila (p. 9). When he had been there for some time, the Tibetan king, Lha Lama Yes'es hod, sent a deputation to India under Rgyā-tsan for inducing Atiçā to come to Tibet, but the latter declined to go (p. 13). Shortly after, this king died in captivity, and was succeeded by his nephew, prince Cān Cūb. After a year (p. 15) the prince sent Nāg-tsō to Vikramaçila again. In that monastery Nāg-tsō stayed for three years (p. 23), and at length persuaded Atiçā to start for Tibet. En route while in Nepal, Atiçā wrote an epistle to the king Nayapāla, named *Vimala-Ratna-Lekhana* (pp. 26 and 31). Atiçā lived in Tibet for twelve years ("thirteen years" in another place), and died in 1053 A.D. (p. 30).

The above data enable us to arrive at the following dates :—

- |   |                        |
|---|------------------------|
| 1. Atiçā died in  | 1053 A.D.              |
| 2. He proceeded to Tibet in<br>(twelve years)                   | 1042 A.D. <sup>2</sup> |
| 3. He met Nāg-tō first in<br>(three years)                      | 1039 A.D.              |
| 4. The Tibetan king died in<br>(one year)                       | 1038 A.D.              |
| 5. Atiçā met Rgyā-tsan in                                       | ? 1036-7 A.D.          |
| 6. He mediated between Nayapāla and<br>the king of Karṇya in    | ? 1035 A.D.            |
| 7. He was appointed (by Nayapāla)<br>high priest of Vikramaçila | ? 1033 A.D.            |

Apparently therefore the king Nayapāla Dēva was reigning in 1033 A.D. His accession could not have taken place much further back, for according to the Sārṇāth inscription (Ind. Ant., Vol. XIV, pp. 139-140), his father Mahipāla was reigning in V.S. 1083 or 1026 A.D. Possibly the king of Karṇya invaded Magadha expecting to have better success with a new, and therefore young and inexperienced king. Considering the various facts, the king Nayapāla might be fairly assumed to

<sup>1</sup> The name of the king has been given in pp. 2 and 11 as Mahipāla, apparently by mistake.

<sup>2</sup> "In 1042 A.D., the famous Atisha, a native of Bengal, who is known in Tibet as Jovo-rje or Jovo-rtishe, also came there." Rockhill's *Life of Buddha*, p. 227.



have ascended the throne between 1030 and 1033 A.D. The fifteenth year takes us to 1044 to 1047 A.D., or briefly, *Circa* 1045 A.D.

Babu Çaratcandra Dās has compiled his article chiefly from Bu-Ston's *Cos hbyuṅ* (rin-tseṅ). Bu-Ston was the principal disciple of Atiçā (Rockhill, p. 227). Consequently his work might mainly be considered contemporaneous, and therefore more reliable than Tārā-nātha's or similar historical works, which appeared long after Atiçā's death.

TEXT.<sup>1</sup>

1. 1. Om̐ Namō Bhagavatē Vāsudēvāya Ṇ Uunidra-nīlakamal-ākara-kāya-kāntiḥ svarṇṇ-ābhirāma-rucira-dyuti-pitavāsaḥ | udbhās-yamāna iva cañcalayā ghanauḅhō Viṣṇuḥ priyādvaya-varēna yunaktu yuṣmān Ṇ [1 Ṇ].<sup>2</sup>
1. 2. Vyānirmāya samasta-vastu-sukhinō viprān prajānām patir=yām=adhyāsta iv=ātman=aiva paritō mūr̥tti-prapañcam dadhat | uttuṅgaiḥ çarad-abhra-çubhra-çucibhiḥ sandhaiḥ kṛt-ālanḅkṛtir=mmōkṣa-dvāram = anarggalam̐ ja—
1. 3. -gati sā Çrimad-Gayā giyatō Ṇ [2Ṇ].<sup>3</sup> Vēd-ābhyāsa-parāya-ṇa-dvija-gaṇ-ōdgirṇṇ-ōgra-pāṭha-kramād = uccair = uccarita-dhvani-vyatikarair = yatn-āvadhāryā girāḥ | kiñ = c = ājasrita-hōma-dhūma-pāṭala-dhvānt-āvṛtau sāmpratam̐ dharmmō
1. 4. yatra mahā-bhayād = iva Kalēḥ kālasya sam̐tiṣṭhatō Ṇ [3Ṇ]. Atyādṛtair=guṇa-nayair=uru-nīla-padma-niçchadma-sadmani satām̐ sukṛt=ābhimarçē | nihāra-hāra-çarad-indu-vivu(bu)ddha-kunda-sandōha-sundara-Mahā-dvija-rāja-vaṅ(m)çē
1. 5. Ṇ [4Ṇ].<sup>4</sup> Ajāta-lakṣma-dvija-rāja-çēkharāḥ samantatō=bhūri-vibhūti-bhūṣaṇaḥ | va(ba)bhūva dhanyō giri-rāja-putrikā-priy-ōpamēyaḥ Paritōṣa-sam̐ñjakah̐ Ṇ [5Ṇ].<sup>5</sup> Ananya-sāmānya-dig-anta-mandiraiḥ tri-varḅga-samsarggi-guṇ-ā—
1. 6. çrayair=jagat | çarat-sudhā-dhāma-gabhasti-taskaraiḥ samantatō yasya yaçōbhir=āvṛtam̐ Ṇ [6Ṇ]. Dvija-vara-vinatā-nandana-niramyā-gatikah̐ samāçritō=lakṣmāyā | tasya tad=anu tanu-janmā mura-ripur=iva Çūdrako bhūtaḥ Ṇ [7Ṇ].<sup>6</sup>
1. 7. Dūr-ōdyāta-çarat-sudhā-nidhi-sudhā-kund-ābhirāma-cchavi-cchā-yaiç=cchannam̐=abhūd=yaçōbhir=abhitō yasya tri-lōki-talam̐ | karpūrain=iva pūritam̐ malayaja-kṣōdair = iv = ālēpitam̐ kṣuvdha(bdha)-kṣīra-payōdhi-tunga-lahari-lēhair = iv = āplā-

<sup>1</sup> From the original and two ink impressions.

<sup>2</sup> Metre Vasantatīlakā.

<sup>3</sup> Metre Çārdulavikṛīṭita; and of the next verse.

<sup>4</sup> Metre Vasantatīlakā.

<sup>5</sup> Metre Vam̐çastha; and of the next verse.

<sup>6</sup> Metre Āryā.

1. 8. vitam || [8 ||].<sup>1</sup> Satyam dharmma-sutē sthiratvam = acalē gāmbhiryam=ambhō-nidhan va (ba)hv-āçarya-guṇā matiḥ sura-gurau tējasvitā bhasvati | etē santi guṇāḥ pṛthak = param = udañcadbhīr=jigīṣā-rasair=**V**viçvādityam=ajījanat=sutam=a-sāv = ebhiḥ samastaiḥ çritam || [9 ||]. Yas = tāpānta-karaḥ sudhā-nidhir = iv = āpūrṇaḥ kalānām gaṇair = yas = tuṅg-ābhuyday-āçritō ravir=iva prauḍha-pratāp-ōdayaḥ | pratyantaḥ karaṇ-ābhivāñchita-phal-ājasra-pradāna-çribhiḥ çliṣṭō
1. 10. jaṅgama-kalpa-vṛkṣa iva yō jātaḥ samast-ārthinām || [10 ||]. Dōrdaṇḍa-dvaya-caṇḍa-vikrama-kaçā-dig-vāji-çaurya-ādbhuta-kriḍ-ōnmūlita-vairi-vargga-vipinaḥ prauḍha-pratāp(?) -āruṇaḥ | vāry-āliṣu yath = āvdi (bdhi)r = āpadi tathā pravya-
1. 11. kta-dhairya-kramaḥ kiñ = ca prākṛta-sarvva-garvva-vimukhaḥ sampatsv = analpāsv = api || [11 ||]. Çriy = ānya-vyāsaṅgō visadṛça-samāçāra-vikalō janō madyēn = ēva skhalanam = upa-hāsañ = ca bhajatē | iyam sā yasya çriḥ samucita-vi—
1. 12. lās-ābhuydayini yath-ārthā s laṅkaraḥ samadhika-jan-ānanda-viçayaḥ || [12 ||].<sup>2</sup> Yasy = ākṛttrima-mēdur-āçrita-mahiparyanta-samvāsibhir = nṛty-ārambha-vijṛmbhaḥ-ōddhata-bhu-jair=udgiyamānā janaiḥ | sānand-ōtpulakaṁ vi—
1. 13. -mānam=asakṛd=dēvair=vvilamv(b)-ām v(b)arē çlāghā-ghūrṇita-mūrdhabhir=nīpatitaiḥ kirttiḥ samākarṇyātē || [13 ||].<sup>3</sup> Sābhyaśūya-paritōṣa-lōçatō vikṣitāni çanakaiḥ sakaṭākṣam | yasya vidviḍ-anukūla-kulāni prāpnavanti nidha—
1. 14. -nāni dhanāni || [14 ||].<sup>4</sup> Ninadanti danti-vara-hanti yāni kucitāni tāni ca durunnayāni | ati-manda-mandam = atigah-varāsu nivasanti santi giri-kandarāsu || [15 ||].<sup>5</sup> Saṁtatēna tatēna tējasā durnnayasya nayasya vidvi—
1. 15. -ṣām | ākulāni kulāni durggamād = durggatāni gatāni durgga-mam || [16 ||].<sup>6</sup> Sapt-ām v(mbu)-rāçi-visarat ç(ac-ch)lathamēkhalāyā asyā bhuvāḥ kati na bhūmi-bhujō=va(ba)bhūvuḥ | siddhim na kasya cid = agād = yad = analpa-kalpais = tōn = ātra kirttanam = akā—
1. 16. -ri Janārdanasya || [17 ||].<sup>7</sup> Kailās-ācala-çṛṅga-sambhramam = adhaḥ-kurvāt = prarūḍh-ōdaya-prālōya-dyuti-kunda-sundara-yaçaḥ-puñj-ōpamēy-ākṛti | yatr = ōtṅga-çikh-āgra-saṅgata-çarac-caṇḍr-āṅ(m)çu-çubhra-çribhir = mmuñcan = nūtaṇa-mañjarir = iva patā—

<sup>1</sup> Metre Çārdūlavikṛḍita; and of the next three verses.

<sup>2</sup> Metre Çikhariṇi.

<sup>3</sup> Metre Çārdūlavikṛḍita.

<sup>4</sup> Metre of first pāda Rathodhatā, the rest Svāgatā.

<sup>5</sup> Metre Jagati.

<sup>6</sup> Metre Akṣarāvati.

<sup>7</sup> Metre Vasantatilakā.

1. 17. -kābhir=nnabhō rājatē || [18]||<sup>1</sup> **Vāji-vaidya-Sahadēva-**  
niruktiḥ tat-praçaṣtir=iyam=astu nitāntam | prēma-sauhṛda-  
sukh-aika-dharitri sajjanasya hṛdayē ramaṇ-iva || [19]||<sup>2</sup>  
**Ḡrimatō s dhīpa-Sōmasya** ātmaḥēn = ārjitaṁ yaçaḥ | u—
1. 18. -tkirṇṇa-karmmaḥi **Ḡrimat-Satṭa-Sōmēna** çilpinā || [20]||<sup>3</sup>  
Samasta-bhū-maṇḍala-rājya-bhāram = āvi(bi)bhrati **Ḡri-Naya-**  
**pāla-dēvē** | vilikhyamānē daça-pañca-saṁ(y)khyā-samvatsarē  
siddhim = agāc = ca kirttiḥ || [21]||<sup>4</sup> ||

*Abstract of Contents.*

Om! Salutation to Vāsudēva. May Viṣṇu with his two wives, Lakṣmī and Sarasvatī, bless you (v. 1). The (town) Gaya where Brahmā has come to reside, and which is ornamented with high buildings, is praised as the unbarred door to salvation in this world (v. 2). There the loud reading of Veda-studying Brahmins makes talk hearable only with care; and the constant smoke of sacrificial fires makes it as if a hiding place for *dharmma* afraid of the *Kali-kāla* (iron age) (v. 3). In the Mahā-dviija family—ever the home of Lakṣmī on account of their virtues, and stainless as the *kunda* flower engrown by the autumnal moon—(v. 4), like Çiva was born Paritōṣa by name (v. 5); whose fame covered the whole world (v. 6). From him was born, like Nārāyaṇa, Çūdraka (v. 7). His fame spread over the three worlds (v. 8). From him was born Viçvādityā in whom the qualities hitherto found separate have combined (v. 9). Verses 10 to 16 sing the praises of Viçvāditya. Many chiefs arose on this earth, but none attained fulfilment so much as he (Viçvāditya) did by erecting a temple (*kirttana*) of Janārdana (v. 17). V. 18 describes the temple in high-flown language. May this *praçaṣti*, the words of the veterinary physician Sahadēva, find its place in the hearts of good men like fair ladies! (v. 19). By the artisan Ḡrimat Satṭa-Sōma, son of Ḡrimat Adhipa-Sōma, (this) fame in inscribing was obtained (v. 20). While Ḡri-Nayapāla Dēva was ruling the whole world, this monument written in (his) fifteenth year attained completion (v. 21).

<sup>1</sup> Metre Çārdūlavikrīḍita.

<sup>2</sup> Metre Svāgatā.

<sup>3</sup> Metre Anuṣṭubh.

<sup>4</sup> Metre Upajāti.

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“It will flourish, if naturalists, chemists, antiquaries, philologists, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.” SIR WM. JONES.

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No. I.—1900.  
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I.—*Materials for a Flora of the Malayan Peninsula.*—By SIR GEORGE KING, K.C.I.E., M.B., LL.D., F.R.S., &c., late Superintendent of the Royal Botanic Garden, Calcutta.

No. 11.

After about two years of unavoidable delay, I am now able to offer to the Society a further contribution towards the completion of these *Materials*. The paper now submitted gives an account of the natural order which, in the sequence hitherto followed, falls to be numbered XLVII. An account of the family *Myrtaceæ* which ought, according to that sequence, to have immediately preceded this one of *Melastomaceæ* is now in preparation, and will I hope before long be ready for presentation to the Society. The present paper is not entirely my own work, the account of the genus *Sonerila* having been most kindly prepared for me by Dr. O. Stapf, First Assistant in the Royal Herbarium, Kew, whose contributions to the Botany of Borneo, published by the Linnean Society of London, have already marked him as an authority on the Malayan Flora.

Order XLVII. MELASTOMACEÆ.

Herbs or shrubs, more rarely trees or climbers. *Leaves* opposite or rarely whorled, generally petioled, entire or nearly so, often palmately 3-5-7-nerved from near the base to the apex (mostly pinnate-veined in *Memecylon*); stipules 0. *Flowers* spiked, paniced or cymose,

J. II. 1

rarely solitary or fascicled, regular, hermaphrodite. *Calyx-tube* united by vertical walls to the ovary, rarely nearly free; limb usually 4-5- (sometimes 3- or 6-)lobed, or truncate, rarely falling off in a cap. *Petals* as many as the calyx-lobes, contorted in bud, inserted on the margin of the calyx-limb. *Stamens* as many as or more than (frequently twice as many as) the petals, inserted with them; alternate stamens often shorter, sometimes rudimentary, filaments bent inwards in the bud; anthers opening at the summit by one or two pores, rarely by slits down the face; connective often appendaged near the base by bristles, tubercles or a spur. *Ovary* 4-5- (rarely 3- or 6-)celled (in *Memecylon* 1-celled); style simple, filiform, rarely short; ovules very many (except in *Memecylon*); placentas axile, parietal or free central. *Fruit* included in the calyx-tube, capsular or berried, breaking up irregularly or by slits through the top of its cells. *Seeds* minute, very many (in *Memecylon* one only); albumen 0; cotyledons short (or in some of the *Memecyleæ* long, thin and convolute).—DISTRIB. Species about 2700, tropical, with a few subtropical; mostly in America, but many in south-east Asia, and a few in Africa and Polynesia.

SUBORDER I. MELASTOMEÆ. *Ovary* 3-6-celled. *Ovules* very many, on placentas radiating from the axis. *Seeds* very many. *Anthers* opening by a single terminal pore (rarely by 2).

Tribe I. OSBECKIÆ. *Seeds* curved through half a circle, minutely punctate.

Stamens all nearly alike. Fruit a berry ... .. 1. OTANTHERA.

Stamens very unequal ... .. 2. MELASTOMA.

Tribe II. OXYSPORÆ. *Seeds* straight, oblong or cuneate, raphe often excurrent. *Ovary* with the vertex usually free, conical. *Petals* more than 3. *Inflorescence* not scorpioid. *Fruit* capsular.

\* *Inflorescence* terminal (see also *Ochthocharis*).

Panicles broad, often coloured ... .. 3. OXYSPORA.

Panicles narrow. Flowers minute ... .. 4. ALLOMORPHIA.

\*\* *Inflorescence* axillary, stamens equal, flowers minute.

Stamens 4 ... .. 5. BLASTUS.

Stamens 10 ... .. 6. OCHTHOCHARIS.

Stamens 8 ... .. 7. ANERICLEISTUS.

Tribe III. SONERILEÆ. *Seeds* straight, oblong or cuneate, often angular, raphe sometimes excurrent. *Ovary* flattened or depressed at the vertex. *Fruit* capsular.

Petals 3. Inflorescence scorpioid ... .. 8. SONERILA.

Petals 4. Flowers in a long-peduncled head ... .. 9. PHYLLAGATHIS.

Tribe IV. MEDINILLEÆ. *Seeds* straight, cuneate or obovate, often angular. *Connective* often appendaged near the base. *Fruit* baccate.

\* *Longer stamens* having two long bristles attached to the base of the connective in front.

Cymes lateral ... .. 10. MARUMIA.

Panicles terminal ... .. 11. DISSOCHÆTA.



\*\* *Longer stamens having the connective at base variously appendaged but not with two long bristles in front (equal and with two short bristles in one species.)*

- Four vertical plates on the ovary ... .. 12. ANPLECTRUM.
- \*\*\* *Stamens equal or nearly so.*
- Connective not at all or very shortly produced at the base, but having 2 tubercles in front and a spur behind ... 13. MEDINILLA.
- Anthers not produced at the base; connective with tufted beard at the base behind but not spurred ... 14. PUGONANTHERA.
- Connective not produced at the base and with no appendages in front, but minutely spurred behind, not bearded ... .. 15. PACHYCENTRIA.

SUBORDER II. ASTRONIEÆ. *Ovary* 4-5-celled; ovules very many on parietal nearly basal placentas. *Seeds* very many. *Anthers* short, opening by slits. *Fruit* baccate.

- Calyx-tube smooth. Panicles terminal ... .. 16. ASTRONIA.
- Calyx-tube verrucose. Cymes small ... .. 17. PTERANDRA.

SUBORDER III. MEMECYLEÆ. *Ovary* 1-celled; ovules about 9 on a basal short free-central placenta. *Stamens* equal; anthers short, opening by pores or short slits. *Berry* 1-seeded.—*Leaves* usually pinnate-nerved.

- Stamens 8 ... .. 18. MEMECLON.

1. OTANTHERA, Blume.

Slender shrubs. *Leaves* membranous, entire, 3-5-nerved. *Panicles* terminal or sub-terminal, lax, cymose, few-flowered. *Calyx* bearing on its ovoid tube simple or tufted bristles, rarely glabrous, the lobes 5 or 6, equal to or shorter than the tube, deciduous. *Petals* 5-6, obovate, the apex rounded or acute. *Stamens* subequal, 10-12; anthers opening by a terminal pore, not beaked, the connective not produced at the base, or slightly biauriculate in front. *Ovary* half-inferior, with 5 or 6 bristles at its apex, 5-6-celled; style filiform, simple; ovules numerous on axile placentas. *Fruit* 5-6-celled, baccate. *Seeds* small, curved, punctate. **DISTRIB.** Species 7 or 8; Malaya, Burma, Philippines, N. Australia.

- Calyx-tube bearing simple bristles ... .. 1. *O. celebica*.
- Calyx-tube quite glabrous ... .. 2. *O. nicobarensis*.

1. OTANTHERA CELEBICA, Blume, Mus. Bot. Lugd. Bat. I, 56. *Leaves* narrowly elliptic, shortly acuminate: upper surface sparsely strigose, the nerves glabrous, lower usually glabrous, the main nerves (and sometimes the minor also) with sub-adpressed bristles: length 2.25-3.5 in., breadth .5-1.5 in., petioles .2-.4 in. long. *Calyx-tube* with simple acuminate bristles often bulbous at the base, the teeth setose. Naud., Ann. So. Nat. Ser. 3, XIII, 353; Cogn. in DC. Mon. Phan. VII, 342.

ANDAMAN ISLANDS; common, *King's Collectors*. DISTRIB. Celebes.

2. OTANTHERA NICOBARENSIS, Teysm. et Binn. Pl. Nov. Hort. Bogor.

29. *Leaves* lanceolate or oblong-ovate, acuminate, upper surface sparsely strigose, the nerves glabrous; lower glabrous except the strigose nerves; length 3 to 4.5 in., breadth 1.25 to 2 in., petioles .5 to 1 in. *Calyx-tube* quite glabrous; the teeth sub-ciliate. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 522; Kurz, Journ. As. Soc. Bengal, 1876, pt. II, 131; Cogn. in DC. Mon. Phan. VII, 342.

NICOBAR ISLANDS; *Novara Expedition*.

This has been collected only by the botanists of the Austrian expedition. It is the only species of the genus with a glabrous calyx.

## 2. MELASTOMA, Linn.

Scaly, strigose or villous shrubs. *Leaves* petioled, oblong or lanceolate, entire, 3-7-nerved. *Flowers* terminal, solitary, clustered or paniced, rose or purple, 5- (rarely 6-7-) merous. *Calyx-tube* ovoid or campanulate, with simple (rarely with penicillate) hairs, lobes deciduous. *Petals* equal in number to the calyx-lobes. *Stamens* twice as many as the petals, very unequal, alternate longer ones with purple anthers having the connective long-produced at the base and terminating in two lobes, the shorter ones having yellow anthers, the connective not produced but with two tubercles in front. *Ovary* ovoid, more or less united to the calyx-tube, 5- (rarely 6-7-) celled, apex bearing bristles; style filiform, simple; ovules very numerous, placentas axile. *Fruit* berried, succulent or coriaceous, enveloped in the calyx-tube, bursting irregularly. *Seeds* minute, very many, curved through half a circle, minutely punctate.—DISTRIB. Species 40; Asia, North Australia and Polynesia.

Calyx-tube densely covered with long, flexuose, spreading, shining, coloured bristly hairs .25 to .5 in. long; young branches, petioles, and pedicels with stiff spreading bristles; flowers 2 to 3 in. in diam. ... 1. *M. decemfidum*.

Calyx-tube, young branches, petioles and pedicels with adpressed, lanceolate acuminate, serrulate scales: cymes condensed, flowers 1.25 in. across ... 2. *M. imbricatum*.

Calyx-tube densely clothed with linear acuminate, entire or serrate scales, those of the young branches, petioles and pedicels shorter and broader; corymba with deciduous (often large) bracts; flowers 2 to 3 in. across (only 1.25 in. var. *perakensis*) ... 3. *M. malabathricum*.

1. MELASTOMA DECEMFIDUM, Roxb. Hort. Beng. 90; Fl. Ind. II, 406. A shrub, 5 to 10 feet high; young branches at the nodes and near the tips, petioles and pedicels with numerous stiff, spreading bristles. *Leaves* narrowly-lanceolate or oblong-lanceolate, acuminate, 3- to 5-nerved; the upper surface smooth except for a few scattered

adpressed hairs, the lower glabrous, glandular-punctate; length 2·5 to 5 in., breadth ·6 to 1·8 in.; petiole ·25 to ·5 in. long. *Flowers* solitary or two or three together, bright purple, 2 to 3 in. in diam., the bracts few, short, acuminate; pedicels under ·5 in. *Calyx-tube* densely covered with long, flexuose, shining, coloured, bristly hairs; ·25 to ·5 in. long, the teeth rather shorter than the tube, ovate-lanceolate, acuminate, glabrous inside, deciduous. *Fruit* ·75 in. in diam., truncate at the apex, ovoid to ovoid-globular, ·5 in. in diam. Jack in Trans. Linn. Soc. XIV, (1822) 6; DC. Prodr. III, 146; Naud., Ann. Sc. Nat. Ser. 3, XIII, 282; Bl. Mus. Bot. I, 55; Cogn. in DC. Mon. Phan. VII, 345. *M. sanguineum*, Sims in Bot. Mag. t. 2241; DC. Prodr. III, 145; Don in Mem. Wern. Soc. IV, 289; Miq. Fl. Ind. Bat. I, pt. I, 504; Naud. l.c. 281; Triana in Trans. Linn. Soc. 60; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 524; Hemsl. in Jour. Linn. Soc. XXIII, 300. *M. malabathrica*, Sims in Bot. Mag. (not of Linn.) 529. *M. Gaudichaudianum*, Naud. l.c. 278. *M. macrocarpum*, Naud. l.c. 281 (not of Don). *M. porphyreum*, Bipp. et Bl. in Flora 1831, II, 487. *M. pedicellatum*, Naud. l.c. 280; Cogn. in DC. Mon. Phan. VII, 346.

PENANG; Wallich 4042! King, Curtis 683. MALACCA; Griffith (K.D.) 2245/1! Maingay 773, 774! Ridley 3228. PAHANG; Ridley 2667. KEDAH; Ridley 5211. PERAK; Scortechini 2123! King's Collector 1540, 1853, 8754. DISTRIB. Burma, China, Hongkong, Tonkin.

VAR. *mollis*, Clarke in Hook. fil. Fl. Br. Ind. II, 524. Young branches very hispid throughout their whole length; leaves with numerous sub-adpressed and spreading stiff hairs on both surfaces, especially on the nerves. Vidal Syn. Pl. Filip. t. 51; fig. D. *M. molle*, Wall. Cat. 4046; Triana in Linn. Trans. XXVIII, 60; Cogn. in DC. Mon. Phan. VII, 346. *M. crinitum*, Naud. l.c. 524. *M. malabathricum* Blanco, Fl. Filip. Ed. III, tab. 152 (not of Linn.).

SINGAPORE; Wallich. DISTRIB. Luzon; Cuming 853.

2. MELASTOMA IMBRICATUM, Wall. Cat. 4047. A spreading shrub, 5 to 15 feet high; young branches (especially at the nodes and tips), petioles, pedicels and calyx covered with adpressed, lanceolate acuminate, serrulate scales. *Leaves* elliptic-oblong to ovate-oblong, rather abruptly narrowed at the base, the apex acute or acuminate; main nerves 5 (the two lateral slender); both surfaces strigose, the main nerves on the lower with adpressed scales; length 3·5 to 8·5 in., breadth 1·5 to 4·5 in., petiole ·35 to 1·35 in. *Cymes* solitary, terminal, condensed, 1·5 to 2 in. in diam., enclosed in bud by deciduous, lanceolate bracts and bracteoles. *Flowers* 7 to 15, 1·25 in. in diam.; the pedicels ·15 in. long. *Calyx-tube* urceolate, the teeth shorter than the tube, lanceolate-acuminate, deciduous. *Petals* oblong. *Anthers* short. *Fruit* ovoid-globose or sub-globose, truncate and shortly toothed at the mouth,

pulpy, .8 in. in diam. when ripe. Triana in Trans. Linn. Soc. XXVIII, 60; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 524; Cogn. in DC. Mon. Phan. VII, 355. *M. obovatum* var. *oblongum*, Bl. ex Triana l.c. 60.

PERAK; *Scortechini* 162! *King's Collector* 444, 6023, 8696, 10946! *Wray* 2980. PENANG; *Wallich, Curtis*. DISTRIB. Sumatra, *Forbes* 2072! Brit. India (Khasia and Assam); Tonquin.

Easily recognised by its condensed cymes and rather small flowers.

3. MELASTOMA MALABATHRICUM, Linn. Sp. Pl. 559. A spreading shrub, 3 to 6 feet high; young branches, petioles and pedicels densely clothed with rather short, acute to acuminate, often serrulate scales. *Leaves* ovate-lanceolate, ovate-oblong or elliptic, the apex acute or shortly acuminate, petioles short, 3- to 5-nerved (the marginal pair when present slender); both surfaces strigose, the hairs sparser on the upper and pale; on the lower the hairs more numerous (especially on the minor nerves) and darker, the main nerves clothed with broad-based acuminate scales: length 2 to 5.5 in., breadth .75 to 2.5 in.; petioles .2 to .5 in. long. *Corymbs* terminal, few-flowered, enveloped in bud by large, deciduous, ovate-cordate bracts; *flowers* 2 to 3 in. across, the pedicels .2 to .4 in. long. *Calyx*; the tube cylindric-campanulate, densely clothed externally with linear acuminate, entire or serrate, pale scales, almost glabrous within; the teeth shorter than the tube (rarely equal to it), acute or abruptly acuminate, the apex deciduous, scaly only near the midribs. *Flowers* 2 to 3 in. across. *Petals* purple. *Fruit* subglobose, truncate, pulpy, .25 in. in diam. when dry. DC. Prodr. III, 145; Roxb. Hort. Beng. 33; Fl. Ind. II, 405; Wall. Cat. 4040; Bl. Bijdr. 1076; Bot. Reg. t. 672; W. and A. Prodr. 324; Wight Ill. t. 95; Dalz. and Gibs., Bomb. Fl. 92; Naud. in Ann. Sc. Nat. Ser. 3, XIII, 285; Thwaites Enum. 106 ( $\alpha$  and  $\beta$ ); Benth. Fl. Aust. III, 293; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 523; Kurz, For. Fl. I, 503, not of Miq. Fl. Ind. Bat. I, pt. I, 507; Naud. in Ann. Sc. Nat. Ser. 3, XIII, 273; Cogn. in DC. Mon. Phan. VII, 349. *M. affine*, D. Don in Mem. Wern. Soc. IV, 288; DC. Prodr. III, 145. *M. obvolutum*, Jack in Trans. Linn. Soc. XIV, 3; Cogn. in DC. Mon. Phan. VII, 348. *M. articulatum*, *M. heterostegium*, *M. novæ-hollandiæ* and *M. sechellarum*, Naud. in Ann. Sc. Nat. Ser. 3, XIII, 285, 286 and 290. *M. velutinum*, Seem. Fl. Vit. 90. *M. Banksii*, Cunn. ex Triana. *Trembleya rhinantha*, Griff. Not. IV, 677.

In all the provinces. DISTRIB. British India and Malayan Archipelago, W. China, Seychelle Islands, N. Caledonia, N. Australia.

A widely distributed species varying in reality very little in localities widely separated. The differences have however been taken as the bases of many bad and doubtful species. In his *Flora Australiensis*, Mr. Bentham remarks (and apparently with justice) that the whole twenty-four species described by Naudin in Ann. Sc.

Nat. Ser. 3, XIII, pp. 288 to 293; should be reduced here. It is not without reluctance that I give four varieties as follows:—

VAR. 1. *polyantha*, Benth. Fl. Aust. III, 292. Bracts of inflorescence small and very early deciduous or altogether absent; teeth of calyx usually short; leaves not exceeding 2·5 in. in length. *M. polyanthum*, Blume in Flora for 1831, 480; Mus. Bot. I, 52, t. 6; Naudin in Ann. Sc. Nat. Ser. 3, XIII, 287; Miq. Fl. Ind. Bat. I, pt. I, 502; Triana in Linn. Trans. XXVII, 59; O. B. Clarke in Hook. fil. Fl. Br. Ind. III, 528. *M. brachyodon*, Naud. l.c. 292; Miq. Fl. Ind. Bat. I, 570, t. 8, fig. A. *M. malabathricum*, Desr. in Lam. Encyc. Bot. IV, 36; Ill. Gen. tab. 361, f. 1; Jack in Linn. Trans. XIV, 4, fig. 1, a to g; Poir. Dict. IV, 37; Bl. Bijdr. 1070. *M. erecta*, Jack l.c. 5; DC. Prodr. III, 145. *M. tidorensis*, Bl. in Flora 1831, p. 482, Miq. l.c. 514. *M. Royenii*, Bl. l.c. 483. *M. tondanense*, Bl. Mus. Bot. I, 54. *M. Hombronianum*, *M. oliganthum* and *M. microphyllum*, Naud. l.c. 278, 292 and 293.

ANDAMANS; *King's Collector*. SINGAPORE; *Anderson, King*. MALACCA; *King*. PENANG; *Curtis, King*. DISTRIB. Burma, N. China, Sumatra, Java and other islands in the Malay Archipelago, Luzon, N. Australia.

VAR. 2. *adpressa*, C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 523. Leaves narrowly oblong-lanceolate, smaller than in the typical plant and with harsher pubescence. *M. adpressum*, Benth. in Wall. Cat. 4081, Naud. l.c. XIII, 27; Cogn. in DC. Mon. Phan. VII, 349. *M. anophanthum*, Naud. l.c. 277.

MALACCA; *Maingay* 771 to 773 in Herb., Kew. PENANG; *Wallich, King, Curtis*. PROVINCE WELLESLEY; *Curtis*.

This is scarcely worthy of separation as a variety. It is slightly smaller and more strigose than the type and differs from VAR. *polyanthum*, so far as I can see, only by the large size of the bracts of the inflorescence.

VAR. 3. *normalis*, King. Hairs of both surfaces very numerous, those of the upper sub-adpressed, of the lower sub-spreading, softer (almost silky); calyx-teeth long, adpressed hairy within. *M. normale*, Don Prodr. Fl. Nep. 220; DC. Prodr. III, 145; Naud. in Ann. Sc. Nat. Ser. 3, XIII, 289; Kurz, For. Flora I, 504; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 524; Triana in DC. Mon. Phan. VIII, 352. *M. Wallichii*, DC. l.c. 146. *M. napalense*, Lodd. Bot. Cab. t. 707. *M. pelagicum*, Naud. l.c. 279. *M. longifolium*, Naud. l.c. 293.

In most of the provinces.

VAR. 4. *perakensis*, King. Leaves more or less broadly elliptic, 5- to 7-nerved, the upper surfaces strigose (sometimes nearly glabrous in old specimens), the lower softly and rather densely pubescent; branches, petioles and pedicels with long, spreading, rather soft hairs; calyx-tube densely clothed with long, flexuose, soft, often ciliate setae,

the lobes large, adpressed strigose on both surfaces: flowers occasionally only 1.25 in. in diam.

PERAK; *Ridley* 2935! *Curtis* 1298! *Wray* 1733, 1883! *King's Collector* 2173, 2091, 8463! *Scortechini* 780. SINGAPORE; *Hullet* 5728. SELANGORE; *Ridley* 1996. DISTRIB. JAVA; *Forbes* 1142a.

This has broader leaves more softly hairy than *VAR. normalis*. The bristles of the calyx are much longer than in any other form of *M. malabathricum* and approach in number, length and density those of *M. sanguineum*, Don. A form of this from Perak, with the calyx-hairs shorter than the type, connects it with *M. imbricatum*, Wall.

### 3. OXYSPORA, DC.

Large spreading shrubs with drooping branches terminated by large, lax, almost naked panicles of rose-purple flowers. *Leaves* opposite, long-petioled, large, 5- to 7-nerved, ovate, acuminate. *Panicle* long, lax, sometimes narrow, the branches decussate, the flowers on the branchlets not glomerulate, bracts very small. *Calyx-tube* ovate, cylindric or funnel-shaped, its teeth 4, short, triangular. *Stamens* 8, four large with elongated anthers and four small, or all equal, opening by a single apical pore; the base produced and bilobed, the connective with or without an appendage. *Ovary* inferior, 4-celled, its apex glabrous; style simple, elongate; ovules numerous; the placentas axile, radiating. *Capsule* dry, elongate, double fusiform, with 8 ribs. *Seeds* numerous, falcate; the raphe lateral, produced at the apex into a point in front. DISTRIB. Seven species, Indian and Malayan.

Antthers dissimilar; petioles not winged	...	...	1. <i>O. stellulata</i> .
Antthers similar:—			
Petioles not winged	...	...	2. <i>O. acutangula</i> .
,, winged	...	...	3. <i>O. Curtisii</i> .

#### NOTE.

The genera *Allomorpha* and *Oxysepora* were so difficult of separation even before the discovery of the new species herein described (*vis.*, *A. alata*, Scort., *O. acutangula* and *O. Curtisii*) that Baillon (*Hist. des Plantes* VII, 48) united them. In Baillon's time *Oxysepora* was distinguished mainly by having four of its eight stamens much larger than and differently coloured from the other four. The three older species (all British Indian) *O. paniculata*, *O. vagans*, and *O. cernua* and the new Malayan one *O. stellulata* have this character, which would form an excellent head-mark for the genus if it did not break down. The character, however, does break down, for in the two Malayan plants here published as *O. acutangula* and *O. Curtisii* the eight anthers are all equal, although in all other respects these plants have the facies of the older species of *Oxysepora*. I have referred these to *Oxysepora* as preferable to the alternative course of putting them into *Allomorpha*, and I have therefore, in order to admit them, modified the generic character of *Oxysepora* as regards anthers. *Oxysepora*, as here defined, thus depends for its separation as a genus on its open paniculate inflorescence and long double fusiform boldly-ridged capsules, while *Allomorpha* is characterised by shortly-branched panicles, on the ultimate branchlets

of which the flowers are clustered in pseudo-glomeruli, while the capsules are not much longer than broad and are often urn-shaped.

1. *OXYSPORA STELLULATA*, King, n. sp. A shrub, 15 to 20 feet high; young branches, petioles, inflorescence and calyx-tube covered with pale, minute, stellate-hairy scales. *Leaves* somewhat unequal, ovate, slightly cordate at the rounded base, the apex shortly apiculate, 7-nerved (the middle nerve very strong); both surfaces free from hairs, but (especially the upper) with numerous minute hairy scales most numerous on the nerves, the transverse veins on the lower very distinct and straight; length 5 to 9 in.; breadth 2.25 to 4.5 in.; petiole 1.25 to 4 in. *Panicle* solitary, terminal, longer than the leaves; the branches in pairs, divaricate; flowers in umbels of 4 to 6 on the ultimate branchlets. *Calyx-tube* funnel-shaped, sub-tetragonous, the mouth with four small triangular teeth, narrowed at the base into the short pedicel. *Petals* 4, orbicular-ovate, blunt, glabrous. *Stamens* 8, very unequal, four linear, purple and twice as long as the other 4 short, yellow. *Disc* of 4 incurved plates. *Ovary* 4-winged. *Capsule* clavate, opening by 4 broad truncate valves; seeds minute, shortly beaked.

PERAK; *Scortechini* 249 in part! *King's Collector* 418, 2851! *Wray* 1224. *DISTRIB.* Sumatra, *Forbes* 3034.

2. *OXYSPORA ACUTANGULA*, King, n. sp. A bush; young branches boldly 4-angled, glabrous. *Leaves* elliptic-oblong, somewhat narrowed to the rounded base, the apex acute, 5-nerved; upper surface glabrous, the lower minutely lepidote-pubescent on the nerves and veins; length 4 to 6 in., breadth 1.75 to 2.5 in., petiole .6 to .75 in., minutely lepidote. *Panicle* solitary, terminal, usually somewhat shorter than the leaves, broadly pyramidal, lepidote-puberulous, many-flowered. *Flowers* (including the stamens) .5 in. long. *Calyx-tube* funnel-shaped, minutely rufous-stellate lepidote, the mouth with 4 small triangular teeth. *Petals* 4, glabrous, broadly ovate, blunt. *Stamens* 7 or 8, equal, lanceolate, acuminate, slightly curved, the lobes at the base short, rounded, appendages none, but a grooved, narrow process on the back of the connective in the lower half. *Capsule* ovoid, narrowed to the equally long pedicel, 8-ridged, glabrous, the mouth with an everted rim, .25 in. long.

PERAK; *Wray* 329.

3. *OXYSPORA CURTISII*, King. A shrub; branchlets bluntly 4-angled not winged, puberulous. *Leaves* ovate-acuminate, the base rounded, not passing into the petiole, 7-nerved, upper surface sparsely strigose, minutely lepidote, the lower glabrous, the edges glandular-serrulate; length 5 to 7 in., breadth 3 to 4 in., petioles 1.5 to 2.5, broadly winged, the wing much expanded at the base and joining that of the opposite leaf. *Panicle* solitary, terminal, spreading, longer than the leaves, with

J. II. 2

numerous 4-angled branches, bracteate, everywhere minutely lepidote; the larger branches bearing a pair of very unequal bracts near the base exactly like the stem-leaves but smaller. *Flowers* on slender pedicels as long as the calyx-tube. *Calyx-tube* cylindric, 8-ribbed, tapering to base and apex; the mouth expanded and truncate but with 4 minute teeth. *Petals* 4, as long as the scaberulous filaments. *Stamens* 8, much exerted; the anthers longer than the filaments and longer than the calyx-tube, linear, acuminate, very slightly lobed at the base and inappendiculate. *Capsules* fusiform, 2 in. long, much expanded at the mouth.

PERAK; *Curtis* 1300.

The only specimen of this which I have seen is in Mr. Curtis's Herbarium.

The species resembles *Allomorpha alata*, Scort. in its eight equal stamens, in the shape of its leaves and in its winged petioles; but differs in its more elongated capsules (which are fusiform instead of globose), in its larger laxer panicles and in its conspicuously bristle-serrate leaves. The two species just described form very marked connecting links between the genera *Allomorpha* and *Oxysepora*.

#### 4. ALLOMORPHIA, Blume.

Shrubs, tall or short. *Leaves* opposite, long-petioled, large, lanceolate, ovate or orbicular, nerved, glabrous or nearly so. *Panicles* terminal, compound, with small flowers in clustered whorls. *Calyx-tube* funnel-shaped or campanulate, limb of 3 or 4 very short lobes. *Petals* 3 or 4, rose or white, small. *Stamens* 6 or 8, nearly equal; anthers attenuated at the top with one pore, cells long-produced and diverging at their bases; connective without appendage. *Ovary* 3- (rarely 4-) celled, enclosed by but nearly free from the calyx-tube; style filiform, simple; ovules very many, placentas axile, 2-fid. *Capsule* small, dry, not much longer than broad, usually urn-shaped, ribbed, opening at the top by 3-4 valves. *Seeds* very many, narrowly obtrapezoidal. **DISTRIB.** Species 5: whereof 4 are from the Malay Peninsula and its attached islands; 1 from Canton.

Petioles not winged:—

Calyx-tube with 3 or 4 teeth; stamens unequal; anthers sagittate

at base; capsule ribbed ... .. 1. *A. exigua*.

Calyx-tube without teeth; stamens equal; anthers only slightly

lobed at the base; capsules not ribbed ... .. 2. *A. Wrayi*.

Petioles winged:—

Branches of the panicle winged; capsule sub-globular ... 3. *A. alata*.

1. **ALLOMORPHIA EXIGUA**, Blume in *Flora* 1831, II, 523. A shrub, 2 to 10 feet high; branches slender, subangular, puberulous or glabrous. *Leaves* elliptic-ovate to ovate-lanceolate, acuminate, those of the same pair often unequal in size; the base rounded or narrowed, not cordate;



upper surface very sparsely strigose (glabrous in old leaves); the lower glabrous, pale, the transverse nerves prominent; length 4.5 to 11 in.; breadth 1.5 to 5 in.; petiole .75 to 4 in. *Panicle* usually solitary, terminal, often longer than the leaves, lax, minutely rusty-pubescent; bracts lanceolate or oblong, deciduous; the *flowers* .1 in. long, shortly pedicellate, in stalked umbels on the ultimate branchlets or in sessile fascicles. *Calyx* rusty-puberulous, with 3 or 4 short broad teeth. *Stamens* 6 or 8, alternately long and short, sagittate at the base and with a small linear appendage behind. *Petals* 3 or 4, rosy. *Capsule* less than .1 in. long, boldly 6-ribbed. Naud. in Ann. Sc. Nat. Ser. 3, XV, 310; Triana in Trans. Linn. Soc. XXVIII, 74; C. B. Clarke in Hook. fl. Fl. Br. Ind. II, 527; Cogn. in DC. Mon. Phan. VII, 464. *Melastoma exigua*, Jack in Trans. Linn. Soc. XIV, 10, tab. 1, fig. 2; DC. Prod. III, 149. *M. impuber*, Roxb. Fl. Ind. II, 405; Wall. Cat. 4048.

MALACCA; *Griffith* 2263 & 4 (K.D.); *Maingay* 776 (K.D.); *Harvey*. PENANG; *Wallich* 4048; *Curtis* 399; *Griffith*; *King*. PERAK; *Scortechini* 227, 383; *Wray* 160; *King's Collector* 450, 2302, 3106. **DISTRIB.** Sumatra; *Forbes* 3062.

There is some variety in this plant as regards size and inflorescence. A slender form, which never exceeds 2 or 3 feet in height and which has smaller leaves than the type, seems worthy of separation as a variety. It appears to have been so recognised by Wallich who, in distributing his Herbarium, distinguished it by the letter *a*. A less distinctly marked form is one in which the flowers are grouped on the branches of the inflorescence in dense almost sessile fascicles.

**VAR. *minor***, King. Leaves narrowly elliptic, tapering much to base and apex, 2 to 4.5 in. long; inflorescence slender, few-flowered, very lax: height only 2 to 3 feet.

PENANG; *Wallich*, Cat. 4048a; *Curtis* 73. PERAK; *Scortechini* 1702; *Wray* 161, 3414; *King's Collector* 2302.

2. **ALLOMORPHIA WREAYI**, King, n. sp. A shrub, 2 to 4 feet high; branches and petioles with flexuose, spreading, ferruginous hairs. *Leaves* 7-nerved, broadly ovate to rotund-ovate, the apex shortly and abruptly acuminate, the base narrowed, the edges obscurely and minutely bristle-toothed: upper surface very sparsely strigose or glabrous, often with minute, brown scales on the chief nerves; lower glabrous; length 5 to 9 in., breadth 3.5 to 5.5 in.; petiole 2.25 to 2.75 in. *Panicles* solitary, axillary, slightly longer than the petioles but much shorter than the leaves, glabrous or rusty puberulous towards the extremities: the branches short, spreading, rather condensed when young, few flowered. *Calyx-tube* widely campanulate, minutely rusty-puberulous or almost glabrous, without ribs; the mouth truncate, slightly waved but not toothed. *Petals* 4. *Stamens* 8, equal, the anthers lobed but not sagittate at the base, the back with a slight supra-basal appendage.

*Capsule* glabrous, sub-globular, slightly contracted below the sub-membranous truncate mouth, under .1 in. in diam.

PERAK; *Wray* 2483; *King's Collector* 2061, 2380, 2773; *Scortechini* 50, 425. PENANG; *Curtis* 2008.

A species allied to *A. exigua*, Bl. but with pubescent branches and petioles, shorter and more contracted panicles, a wider, toothless calyx-tube, sub-globular capsules and equal anthers only slightly lobed at the base. In Mr. Wray's field-note on his specimens he remarks that the flowers are white and the leaves dark shining green above and crimson beneath.

3. ALLOMORPHIA ALATA, Scortechini Mss. A glabrous shrub, 3 to 6 feet high; the branchlets broadly winged. *Leaves* ovate or elliptic-ovate, the apex shortly acuminate; the base narrowed into the broadly-winged petiole, 5-nerved; both surfaces glabrous, the edges shortly bristle-toothed; length 5 to 10 in., breadth 2.5 to 4.5 in., petiole .75 to 4 in. *Panicle* solitary, terminal, often nearly as long as the leaves, lax; its branches diverging, 4-angled and 4-winged, very minutely rusty lepidote-puberulous. *Flowers* clustered in small umbels near the ends of the branches, the bases of the umbels sometimes with a ring of bracteoles and minute imperfect flowers. *Calyx-tube* cylindrical-ovoid, the limb expanded and with 4 small, persistent teeth. *Petals* 4, twice as long as the calyx-teeth but shorter than the filaments. *Stamens* 8, equal, exerted, much longer than the calyx-tube. *Anthers* linear-acuminate, longer than the scaberulous filaments, very slightly lobed at the base and almost inappendiculate. *Capsules* sub-globular, 8-ribbed, glabrous, the mouth truncate, diam. .1 in.

PERAK; *Scortechini* 236; *Wray* 1327; *Curtis*; *King's Collector* 572, 2047.

The leaves of the same pair differ, often considerably, in size.

#### 5. BLASTUS, Lour.

Shrubs. *Leaves* membranous, petiolate, ovate- or oblong-lanceolate, acuminate, entire or sinuate-serrate, 3- to 5-nerved. *Flowers* small 4-merous, ebracteolate. *Calyx-tube* oblong-campanulate or shortly oblong; the limb not expanded, truncate, minutely 4-lobed. *Petals* 4, ovate, obtuse, glabrous, convolute into a cone before expansion. *Stamens* 4, equal, the filaments thin: anther incurved subulate, opening by a single apical pore; basal lobes divaricate, the connective inappendiculate. *Ovary* adhering to the calyx, 4-celled; style filiform; stigma punctiform. *Capsule* obovoid or sub-globular, slightly 4-grooved; dehiscing slowly by 4 valves. Seeds minute, numerous, irregularly recurved, reniform. **DISTRIB.** 3 species in Malaya, China, Cochin China and India.

**BLASTUS COGNIAUXII**, Stapf in Hook. Ic. Pl. t. 2311. A shrub, 6 to 10 feet high; young branches slender, as thick as a crow-quill, scaly, glabrous or puberulous. *Leaves* equal, oblong-lanceolate, narrowed at the base, the apex acuminate, 5-nerved (the marginal pair faint), the edges sub-entire; upper surface glabrous, with a few scattered, small glands; lower glandular-punctate, minutely furfuraceous on the nerves; length 4 to 7 in.; breadth 1 to 2.25 in., petiole .3 to .75 in. *Panicles* axillary or terminal, slender, much shorter than the leaves, glandular-scaly, the few divaricate branchlets bearing the flowers in dense terminal glomeruli of 6 to 9. *Calyx* shortly tubular, scaly, the teeth minute. *Anthers* narrowly ovate with many small yellow glands near the base. *Capsule* subglobular, truncate, .1 in. in diam., subglabrous; seeds linear. *Ochthocaris parviflora*, Cogn. in DC. Mon. Phan. VII, 421.

PERAK; common. **DISTRIB.** Borneo.

This is closely allied to *B. cochinchinensis*, Lour., but differs notably in its paniculate inflorescence.

### 6. OCHTHOCHARIS, Blume.

Small, erect, glabrous shrubs, branches round or obtusely 4-angled. *Leaves* opposite, petioled, oblong or lanceolate, 3-7-nerved, minutely denticulate-serrulate. *Flowers* minute, in axillary clustered cymes, rarely in axillary lax cymes or in lax terminal cymose panicles. *Calyx-tube* obovoid, smooth; teeth 5, small, persistent. *Petals* 5. *Stamens* 8 or 10, equal; anthers oblong, obtuse at the top, opening with one pore, at the base shortly produced or not; connective with or without an appendage. *Ovary* inferior, 4- or 5-celled, glabrous at the apex; style simple, filiform; ovules very many, placentas axile. *Capsule* globose, 5-valved, enclosed by the membranous calyx-tube. *Seeds* very many, irregularly club-shaped. **DISTRIB.** Species 5 or 6, extending from Singapore to Borneo.

Connective of anthers with no appendage at the base behind:—

Flowers in a terminal panicle, 5-merous	...	...	1. <i>O. paniculata</i> .
„ fascicles, 4-merous	...	...	2. <i>O. borneensis</i> .

Connective of anthers with an appendage at the base behind:—

Erect; flowers 5-merous; leaves 3-nerved	...	...	3. <i>O. javanica</i> .
Decumbent; flowers 4-merous; 5- to 7-nerved...	...	...	4. <i>O. decumbens</i> .

1. **OCHTHOCHARIS PANICULATA**, Korth. in Verh. Nat. Gesch. Bot. 247 t. 64. A small shrub with slender quadrangular branches, rusty pubescent towards the tips. *Leaves* membranous, elliptic-lanceolate, tapering to each end, the edges minutely bristle-serrate, 5- to 7-nerved (the marginal pair faint); upper surface glabrous; the lower somewhat pale,

scaly-puberulous on the nerves and prominent transverse veins; length 2·5 to 5 in., breadth 1·25 to 2 in., petiole ·35 to 8·5 in. *Panicle* cymose, terminal, spreading, less than half as long as the leaves; branches opposite, pedicels unequal, bracteolate at the base, not quite so long as the flowers. *Petals* 5, ovate-acuminate. *Stamens* 10, anthers oblong, blunt, not produced at the base and with the connective inappendiculate. *Capsule* depressed-globular, glabrous, with 5 shallow grooves, ·2 in. in diam. Blume Mus. Bot. I, 40; Naud. in Ann. Sc. Nat. ser. 3, XV, 307, with fig.; Miq. Fl. Ind. Bat. I, pt. I, 556; Triana in Trans. Linn. Soc. XXVIII, 74. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 528; Cogn. in DC. Mon. Phan. VII, 480. *Melastoma oxyphyllum*, Benth. in Wall. Cat. 4083.

SINGAPORE; *Wallich*. DISTRIB. Borneo.

2. *OCHTHOCHARIS BORNEENSIS*, Blume Mus. Bot. Lugd. Bat. I, 40. A shrub, 3 or 4 feet high. *Leaves* membranous, elliptic-lanceolate, 5-nerved (the lateral pair small), acuminate, the base cuneate, the edges minutely dentate, upper surface glabrous, the lower pale, minutely and furfuraceously stellate-hairy on the main and rather prominent transverse nerves; length 3 to 4·25 in.; breadth 1·25 to 1·75 in.; petioles sparsely stellate-hairy, unequal, ·3 to 1·8 in. long. *Flowers* in fascicles of 4 to 7, from tubercles on the stem below the leaves; the buds conical, ·1 in. long; pedicels slender, ebracteolate, ·25 to ·3 in. long. *Petals* 4, broadly ovate, narrowly acuminate. *Stamens* 8; the anthers oblong, blunt, neither produced nor appendiculate at the base. *Capsule* depressed-globular, glabrous, faintly 5-grooved, ·2 in. in diam. Naud. in Ann. Sc. Nat. Ser. 3, XV, 307; Cogn. in DC. Mon. Phan. VII, 480. *O. buruensis*, Teysm. and Binn. in Nat. Tijdschr. Ned. Ind. XXV, 426; Miq. in Ann. Bot. Lugd. Bat. I, 216.

SINGAPORE; *Ridley* 6221. DISTRIB. Borneo, Molluccas.

3. *OCHTHOCHARIS JAVANICA*, Blume in Flora 1831, 523. A shrub, 2 or 3 feet high. *Leaves* subcoriaceous, lanceolate or oblong-lanceolate, acute, the base cuneate, 3-nerved; both surfaces glabrous and with the nerves indistinct; the lower rather pale when dry, the edges remotely bristle-serrate; length 2 to 3·5 in.; breadth ·6 to 1 in.; petiole ·2 to ·5 in. *Cymes* or fascicles about as long as the petioles, few-flowered; pedicels slender, minutely bracteolate at the base, ·15 to ·45 in. long. *Flower-buds* ·15 in. long, much pointed. *Petals* 5, broadly ovate, abruptly acuminate. *Anthers* 5, twice as long as the filaments, minutely spurred at the base behind. *Capsule* subglobular, with 5 shallow grooves, glabrous, ·15 to ·2 in. in diam.; the placentas persistent, woody, rough on their outer surfaces. Naud. in Ann. Sc. Nat. Ser. 3, XV, 307; Miq. Fl. Ind. Bat. I, pt. I, 556; Kurz, For. Fl. I, 507. Triana Melast. 74, tab. VI, fig. 67; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 528;

Cogn. in DC. Mon. Phan. VII, 480. *Melastoma? littoreum*, Wall. Cat. 4087.

A sea-shore plant, SINGAPORE, JOHORE, MALACCA, PERAK. DISTRIB. Burma, Borneo, Java.

4. *OCRTHOCHARIS DECUMBENS*, King, n. sp. A creeping or decumbent shrub, 3 to 5 feet long; stems as thick as a swan's quill, rounded, often rooting at the nodes. *Leaves* thinly coriaceous, elliptic-lanceolate, shortly acuminate, rounded or cuneate at the base, the edges obscurely bristle-serrate, 5-7-nerved; upper surface glabrous; the lower pale and with a few minute, scattered scales; length 5 to 7.5 in.; breadth 2 to 3 in.; petioles unequal, stout, sparsely scaly, .5 to 1.25 in. long. *Flowers* in dense, axillary cymes shorter than the petioles, the pedicels short, bracteolate. *Calyx-tube* glabrous, faintly ribbed, the teeth 4, small. *Petals* 4, broadly ovate, acuminate. *Stamens* 8; the anthers curved, tapering to the truncate apex, slightly produced at the base and with a minute tubercle behind. *Capsule* depressed-globose, glabrous, faintly 4-grooved, .18 in. in diam.

PERAK; *King's Collector*, 2833, 10425.

7. *ANERINCLEISTUS*, Korth.

Shrubs; branches often round. *Leaves* petioled, ovate or lanceolate, entire, 3-7-nerved. *Flowers* small. *Calyx-tube* campanulate or funnel-shaped; lobes 4, usually very small. *Petals* 4, minute, glabrous. *Stamens* 8, equal; anthers attenuate at the top, opening by one pore, scarcely produced at the base; connective with or without a short spur. *Ovary* nearly free, 4-celled; style filiform, simple; ovules many. *Capsule* splitting by 4 large valves at the summit. *Seeds* exceedingly minute, cuneate-obovoid. DISTRIB. Species 9 or 10; Malaya and Burma.

Inflorescence umbellate; leaves small, oblong- or elliptic-lanceolate:—

Nearly glabrous in all its parts ... .. 1. *A. macranthus*.

More or less pilose:—

*Calyx-tube* mealy tomentose, the teeth narrow, glandular ciliate on the edges ... .. 2. *A. Scortechinii*.

*Calyx-tube* not tomentose but with many long spreading gland-tipped hairs, the teeth minute and without hairs ... .. 3. *A. Curtisii*.

Inflorescence a large panicle; leaves large, ovate:—

Panicle densely tomentose, leaves 7-nerved ... .. 4. *A. floribundus*.

Panicle clothed with short, flat, adpressed, scale-like hairs, leaves 5-nerved ... .. 5. *A. sublepidotus*.

1. *ANERINCLEISTUS MACRANTHUS*, King, n. sp. A small shrub; young branches with pale lenticels, glabrous except for a few adpressed hairs at the apices. *Leaves* nearly equal, elliptic-lanceolate, much narrowed to the base, the apex shortly acuminate; both surfaces

glabrous, the lower pale when dry; length 2.5 to 4 in., breadth .8 to 1.5 in., petiole .4 to .8 in., strigose. *Umbels* axillary or terminal, usually solitary, 4-5-flowered, on slender, sparsely strigose peduncles shorter than the leaves. *Flowers* (including the stamens) .5 in. long. *Calyx-tube* infundibuliform, sparsely adpressed-pilose, nearly as long as the slender strigose pedicel; the mouth with 4 narrowly triangular acuminate, erect, persistent teeth nearly as long as the tube. *Petals* 4, ovate, acuminate, glabrous, slightly longer than the calyx-teeth. *Stamens* 8, slightly unequal, the alternate 4 shorter but of the same shape as the longer 4, the base in all emarginate, scarcely lobed but with a very short process behind. Scales of disc 4, their apices broadly truncate and slightly toothed. *Capsule* globose-ovoid, .25 to .3 in. long.

PERAK; at elevations of 2000 to 4000 feet, *Scortechini*; *Wray* 297, 1621.

A species near to *A. hirsutus*, Korth., but differing in being glabrous and in having larger flowers which, according to Mr. Wray, are pink. The umbels of this, when in bud, are enclosed in oblong, deciduous, sparsely strigose bracts.

2. *ANERINCLEISTUS SCORTECHINII*, King, n. sp. A slender shrub, 3 to 4 feet high; young branches, petioles and inflorescence with many spreading and sub-adpressed, gland-tipped hairs. *Leaves* very unequal (one of each pair very small), oblong, slightly narrowed to the rounded base, the apex acuminate, the edges ciliate; main nerves 3 to 5, the minor nerves transverse, rather faint; both surfaces usually glabrous, the upper sometimes sparsely strigose, the main nerves on both and the transverse on the lower surfaces bristle-hairy; length of the larger leaf of the pair 2.5 to 4 in., breadth .8 to 1.4 in.; petiole .3 to .4 in.; the smaller leaf of the pair from one-fourth to one-half as large and sessile. *Inflorescence* axillary, solitary on a slender peduncle about as long as the smaller leaf, umbellately cymose, 6- to 10-flowered. *Calyx-tube* globose-campanulate, minutely mealy tomentose, about as long as the pedicel; teeth 4, narrow, reflexed, each ending in a bristle and the margins bearing 6 or 8 long straight hairs with small glandular apices. *Petals* 4, ovate, glabrous, shorter than the calyx-teeth, each with a slender, gland-tipped, reflexed hair at the apex. *Anthers* 8, equal, acute, very slightly lobed at the base and inappendiculate; *style* thick, straight; stigma small. *Ovary* crowned by obtuse, sometimes crenulate scales.

PERAK; *Scortechini* 51, 450; *Curtis*.

This closely resembles *A. Curtisii*, Stapf, but is distinguished at once by the calyx which has its tube covered with minute mealy pubescence while the teeth are long, reflexed, with long glandular hairs on the edges, whereas in *A. Curtisii* the calyx-tube bears many long glandular hairs and the teeth are triangular, minute

and hairless. The leaves of *A. Curtisii* moreover are strigose between the nerves on both surfaces.

3. *ANERINCLEISTUS CURTISII*, Stapf in Kew. Bull. for 1892, p. 196. A small shrub, like *A. Scortechinii*, the young branches, petioles, and inflorescence spreading slightly and not gland-tipped; leaves as in *A. Scortechinii* but strigose on both surfaces. *Calyx-tube* with numerous subulate, gland-tipped, spreading hairs; the teeth minute, triangular and without hairs. *Anthers* blunt.

PENANG; *Curtis* 412.

4. *ANERINCLEISTUS FLORIBUNDUS*, King, n. sp. A shrub, about 15 feet high: young branches, petioles and panicles densely and shortly tawny-tomentose. *Leaves* unequal, ovate, shortly acuminate, 7-nerved at the rounded base, (the main nerve giving off a pair about 1 in. from the base); upper surface with a few short scattered bristles, the main nerves densely bristly-pubescent; lower surface with short coarse hairs especially on the nerves and veins; length 5 to 9 in.; breadth 4 to 5.5 in.; petiole 1 to 2 in., one leaf of each pair smaller than the other. *Panicle* terminal, solitary, longer than the leaves, much branched, the branches unequal and in pseudo-whorls, many-flowered, the ultimate branchlets few-flowered, cymose. *Calyx-tube* funnel-shaped, tapering into and longer than the pedicel, adpressed-pilose: the mouth truncate and with 4 small broadly triangular teeth and 4 alternating tufts of inwardly-directed hairs. *Petals* 4, shorter than the calyx-tube, broadly triangular or occasionally quadrate, apiculate, glabrous. *Stamens* 8, equal, or 2 smaller and sometimes suppressed; *anthers* curved, with two deep broad lobes at the base but no appendage. *Capsule* broadly obovoid, truncate, tapering at the base; seeds minute, broadly linear.

PERAK; *Scortechini* 249 in part; *Ridley* 5342; *Curtis* 1299.

5. *ANERINCLEISTUS SUBLEPIDOTUS*, King, n. sp. A shrub, 10 to 15 feet high; young branches, petioles and inflorescence densely clothed with short, flat, adpressed, scale-like pale hairs. *Leaves* somewhat unequal, ovate, shortly acuminate, on long petioles, 5-nerved, entire; upper surface glabrous except for a few minute scale-like hairs, the main nerves hairy like the petiole; lower surface much reticulate, minutely lepidote-hairy, the middle nerve hairy like the petiole; length 4 to 8 in., breadth 2 to 4 in.; petiole 1 to 1.5 in. *Panicle* terminal, solitary, erect in flower, pendent in fruit, usually longer than the leaves, few-branched; the ultimate branches unequal, short, few-flowered, some of them in pseudo-whorls, pedicels less than .1 in. long. *Calyx-tube* .15 in. long, (when dry) reddish, clothed with scattered, adpressed scale-like hairs, tubular-campanulate; the teeth 4, short, acute. *Petals* 4, ovate, acuminate, glabrous, shorter than the calyx-tube. *Stamens* 8,

subequal, all yellow, curved, deeply lobed at the base but inappendiculate. *Capsule* obovoid, much tapered to the pedicel, .15 in. long (when dry), scabrid from the stiff, strigose, scale-like hairs. *Seed* minute subulate.

PERAK; *Scortechini* 310; *King's Collector* 8068.

#### NOTE.

I take the opportunity to describe here the undernoted new species from Borneo.

*ANERINCLEISTUS GLOMERATUS*, King, n. sp. A shrub; young branches, petioles, main nerves of leaves and inflorescence densely covered with short, coarse, adpressed, pale hairs. *Leaves* narrowly oblong, narrowed towards the base, the apex acuminate; upper surface glabrous but with a few scattered glands; lower surface with a few pale hairs of unequal length on the bold transverse veins; length 3.5 to 8 in.; breadth 1 to 2 in.; petiole .5 to 1.5 in. *Panicle* solitary, terminal, very narrow, bearing a few very short, almost sessile, 4- to 6-flowered umbels. *Flowers* on pedicels about half the length of the calyx-tube. *Calyx-tube* short, campanulate, pubescent; the mouth wide and with 4 short, triangular, acute, spreading teeth alternating with tufts of hair. *Petals* 4, narrowly oblong, spreading. *Stamens* 8, equal; *anthers* slightly lobed at the base, inappendiculate. *Ovary* 4-ridged, 4-celled; *ovules* numerous. *Capsule* sub-globular.

BORNEO; Sarawak, *Hullett* 257.

A species resembling *A. anisophyllus*, Stapf, in the shape of its leaves. The inflorescence is however very different; and in its short subsessile panicle recalls to one's memory *A. Beccarianus*, from which its leaves distinguish it at once.

#### 8. SONERILA, Roxb.

Low herbs, rarely half-shrubs. *Leaves* membranous or more or less fleshy, opposite, those of a pair similar in shape, although often very different in size, or distinctly heteromorphous and then often apparently alternate, usually more or less oblique, 3-7-nerved from the base or near the base, rarely pinnate-nerved. *Flowers* pink or white, in scorpioid simple or pseudo-umbellate cymes, 3-nerved. *Calyx* sub-cylindrical, turbinate or campanulate, 3-lobed or 3-toothed. *Petals* ovate, obovate or oblong, acute, acuminate or obtuse. *Stamens* 3, equal, rarely 6 and slightly unequal; *anthers* linear, oblong or lanceolate, obtuse, acute or (often long) acuminate, minutely 2-lobed at the base, without appendages, dehiscing with apical pores. *Ovary* attached to the calyx-tube by narrow longitudinal septa, depressed at the apex, 3-celled; *style* filiform; *stigma* punctate or capitellate. *Fruit* enclosed in the persistent, ultimately spongy calyx-tube and forming with it a usually more or less trigonous, subcylindrical, turbinate or hemispherical false capsule, dehiscing from the centre of the depressed top with 3 valves or 6 fine teeth. *Seeds* minute, numerous, ovoid, pyramidal or clavate,



smooth or asperulous; raphe usually thick, spongy. Species over 100 throughout tropical Asia.

Leaves similar, although often very unequal in size. Stamens 3. Fruit usually smooth (see No. 12-14); valves entire, distinct, exceeding the margin of the mature calyx (§ *Eu-Sonerila*):—

Erect or ascending herbs with fibrous roots and without rhizome:—

Calyx very slender (also in fruit); stem with 2 somewhat raised, commissural lines. Very scantily hairy or glabrous, often much branched and small- or narrow-leaved (except No. 1) herbs:—

Leaves ovate, 1-1.7 in. by .7-.9 in. ... .. 1. *S. epilobioides*.

Leaves much smaller or at least very much narrower:—

Anthers .12-.18 in. long:—

Leaves oblong to elliptic-oblong, .3-.5 by .15-.23 in. ... .. 2. *S. calaminthifolia*.

Leaves lanceolate, 1-1.75 in. by .15-.23 in. ... 3. *S. hyssopifolia*.

Anthers .06-.09 in. long ... .. 4. *S. erecta*.

Calyx more or less oblong- or ovoid-campanulate; fruit turbinate or obpyramidal. Stem terete or quadrangular:—

Leaves more or less ovate, long acuminate, 1-2 in. by .4-1 in. or still smaller, acutely and coarsely toothed, thin, 3-5-nerved from the very base; petioles long, very slender ... .. 5. *S. tenuifolia*.

Leaves usually larger, not coarsely toothed:—

Upper side-nerves starting from above the base:—

Leaves pinnatinerved, acute or acuminate at the base ... .. 6. *S. flaccida*.

Leaves not pinnatinerved (rarely subpinnatinerved in No. 7); all the side-nerves springing from near the base, rarely the uppermost from near the middle:—

Cymes distinctly peduncled:—

Anthers subacute, .09-.12 in. long; leaves membranous, rounded or subcordate at the base ... .. 7. *S. andamanensis*.

Anthers slender, acuminate, .2-.3 in. long:—

Stem, petioles and inflorescence minutely tomentose; leaves thinly membranous, subcordate at the base on very long and slender petioles ... .. 8. *S. populifolia*.

Stem, petioles and inflorescence with long hairs; leaves acute or rounded, but not subcordate at the base:—

Leaves membranous, more or less oblong, usually acute at the base ... 9. *S. pallida*.

Leaves somewhat fleshy, rounded at the base:—

Hairs more or less spreading, often very long, particularly on the petioles and near the leaf margins; leaves light-brown beneath ... 10. *S. rudis*.

Hairs adpressed, very soft; leaves glaucous beneath with rufous hairs ... 11. *S. mollis*.

Cymes sessile, reduced to few-flowered fascicles:—

Unbranched or almost unbranched herbs:—

Leaves fleshy, very dark and glabrous above, glaucous or pale-brown with rufous nerves beneath; calyx with scattered gland-tipped hairs ... 12. *S. albiflora*.

Leaves membranous, more or less covered on both sides with rufous flexuous hairs; calyx densely hirsute ... 13. *S. lasiantha*.

Suffrutescent, much branched ... 14. *S. suffruticosa*.

All the nerves springing from the very base of the leaf; adult leaves quite glabrous, broadly elliptic, fleshy ... 15. *S. elliptica*.

Herbs with short stems, springing from a creeping rhizome and with usually crowded to rosulate leaves and terminal or subterminal peduncled cymes:—

Leaves 3-7 in. by 2-4 in., 7-nerved from the very base with conspicuous subhorizontal transverse veins:—

Stem, petioles and peduncles very succulent, stout ... 16. *S. succulenta*.

Stem, petioles and peduncles usually slender ... 17. *S. repens*.

Leaves small; uppermost side-nerves springing from above the base; transverse veins indistinct or 0:—

Leaves oblong to lanceolate-oblong, 2-3·7 in. by ·3-1·4 in., pinnatinerved ... 18. *S. muscicola*.

Leaves much smaller, not or very indistinctly pinnatinerved, lateral nerves springing from below the middle:—

Leaves oblong-lanceolate to lanceolate, acute at both ends ... 19. *S. sarosa*.

Leaves ovate to elliptic or oblong, rounded or subcordate at the base:—

Stem 1-3 in. long; leaves broad, crowded, in about 3 pairs; petioles ·8-7 in. long:—

Leaves entire, not ciliate; ·9-1·7 in. by ·6-1·2 in.; petals ·35 in. long; anthers ·15-2 in. long ... 20. *S. congesta*.

Leaves toothed, ciliate, ·4-8 in. by ·4-6 in.; petals ·25 in. long; anthers ·12-15 in. long ... 21. *S. Griffithii*.

Stem shorter; leaves narrower, more numerous, subrosulate; ·8-1·4 in. by ·4-6 in., often beautifully variegated; petioles up to 1 in. long, very slender ... 22. *S. Cyclaminella*.

Leaves of each pair similar in shape, but very unequal in size or one quite suppressed. Stamens 6. Fruit as in *Eu-Sonerila* (§ *Sonerilopsis*, *Miq.*) ... .. 23. *S. heterostemon.*

Leaves of each pair very dissimilar in shape and size, one very small and more or less rotundate or reniform-cordate, often deciduous. Cymes usually from the axils of the small leaves, hence often apparently leaf-opposed. Anthers 3, oblong, obtuse, not over .15 in. long. Fruit more or less turbinate or semiglobose, obscurely trigonous, usually conspicuously muricate; valves not or very slightly exceeding the margin of the mature calyx, often not or indistinctly separating from each other at the periphery, but each of them always splitting into 2 membranous teeth in the depressed centre of the fruit. (§ *Hexodon*, *Stapf*):—

Cymes distinctly, densely and persistently bracteate, distinctly and often long peduncled:—

Cymes simple or 2 or more, sessile on a common peduncle, forming a dense head:—

Cymes simple, at length 1-1.5 in. long; leaves obliquely oblanceolate to obovate-oblong, 3-7 in. by 1-1.5 in.:—

Leaves fleshy, glabrous with the exception of the minutely strigillose nerves of the underside ... .. 24. *S. integrifolia.*

Leaves membranous, with rather long and spreading hairs beneath and along the margins ... .. 25. *S. bracteata.*

Cymes usually 2 or more, sessile on a common peduncle, very short, gathered in a dense head; leaves obliquely obovate, elliptic or oblong, 4-6 in. by 1.75-3 in. ... .. 26. *S. capitata.*

Cymes usually 2 or more on a common peduncle, each with a special peduncle, gathered in a loose umbel; leaves obliquely elliptic, 3-5 in. by 1.75-2.75 in. ... .. 27. *S. caesia.*

Cymes ebracteate, or indistinctly or deciduously bracteate:—

Cymes sessile or subsessile; peduncle, if any, less than .5 in., when mature; fruit muricate:—

Cymes dense, indistinctly bracteate, sessile:—

Bracts linear, usually minute, or suppressed; calyx pubescent; leaves fleshy, firm when dry, glabrous above, shortly and adpressedly pubescent or tomentose beneath ... .. 28. *S. Nidularia.*

Bracts filiform, ciliate, hidden among long spreading hairs; calyx shaggy; leaves membranous, very hairy on both sides ... .. 29. *S. brachyantha.*

Cymes subsessile somewhat loose, ebracteate or deciduously bracteate:—

Leaves obliquely obovate-lanceolate to oblong, 2.5-6 in. by 1-2.5 in.:—

Leaves somewhat fleshy, firm, when dry with conspicuous transverse veins; pedicels very

- slender, to .25 in. long; calyx with short, fine, spreading hairs; fruit .08–.1 in. long, finely muricate ... .. 30. *S. microcarpa*.
- Leaves membranous with conspicuous raised transverse veins; pedicels slender, .08–.12 in. long; calyx with long spreading hairs; fruit .15–.18 in. long, coarsely muricate ... .. 31. *S. costulata*.
- Leaves obliquely elliptic, 4–6 in. by 2.2–3.5 in.; fruit .2 in. long ... .. 32. *S. macrophylla*.
- Cymes distinctly, often long, peduncled:—
- Cymes 2 or more gathered in an umbel, or if simple, then with a pair of (often minute) leaves at the middle:—
- Calyx hairy; fruit muricate:—
- Cymes usually compound, minutely bracteate, axis shaggy; leaves more or less hairy all over ... .. 33. *S. paradoxa*.
- Cymes usually simple, deciduously bracteate; bracts small; axis shortly hairy; leaves glabrous (in the Peninsular specimens) with the exception of the very shortly and scantily hairy nerves and veins of the underside ... .. 34. *S. begoniaefolia*.
- Calyx glabrous; fruit smooth ... .. 35. *S. glabriflora*.
- Cymes simple, ebracteate; peduncle naked:—
- Softly hairy or tomentose all over:—
- Leaves oblong-elliptic or obovate, 2.2–2.8 in. by 1–1.2 in., petals .18 in. long ... .. 36. *S. elatostemoides*.
- Leaves oblong to lanceolate-oblong, 3–6 in. by 1–1.5 in.; petals .35 in. long ... .. 37. *S. bicolor*.
- Shortly tomentose on stem, petioles and peduncles and pubescent on the nerves on the underside of the leaves, otherwise glabrous; fruit smooth ... .. 38. *S. Calycula*.

1. *SONERILA EPILOBIOIDES*, Stapf and King. An erect, sparingly branched, almost quite glabrous herb, about 6 in. high. *Stem* with 2 prominent very minutely hairy lines or quite glabrous. *Leaves* of each pair similar in shape and equal or almost equal in size, ovate, acute or subacute, acuminate at the base, minutely toothed, thinly membranous, green, glabrous or with few scattered, soft, adpressed hairs above, 1–1.75 in. long by .7–.9 in. broad, finely 5- (rarely 3-) nerved from the very base with a few delicate side nerves higher up; petiole .4–.5 in. long, slender. *Cymes* terminal, peduncled, rather loosely 5–6-flowered, glabrous; peduncle .6–.8 in. long, slender; pedicels at length up to .2 in. long, very slender. *Calyx* very slender, obconical, .25–.3 in. long; teeth broad, triangular, mucronulate. *Petals* elliptic-oblong, acuminate-apiculate, .2 in. long, pink. *Anthers* subacute; .12 in. long. *Style* filiform, .12–.15 in. long; stigma subcapitate. Mature fruit unknown.

KEDAH; Santow, on the limestone islands, *Ourtis* 2114!

2. *SONERILA CALAMINTHIFOLIA*, Stapf and King. An ascending or almost prostrate branched herb, from a few inches to 1 ft. high, with very minute, spreading hairs all round or along the 2 commissural lines of the stem and branches, or glabrescent below and with scattered, adpressed, short, straight or flexuous hairs on the upper side of the leaves. *Stem* terete below, quadrangular in the upper part, purple, like the branches slender and often flexuous. *Leaves* petioled, rarely the uppermost sessile and then sometimes apparently whorled, those of a pair similar in shape and size, symmetrical, oblong to elliptic-oblong, subobtuse, narrowed into the petiole, acutely toothed with the teeth usually mucronate and the margin revolute, rather stoutly membranous or almost fleshy, pale-green, purple along the midrib, .3-5 in. by .15-23 in., 1-nerved or with 1 very fine side-nerve on each side from near the base; petioles .08-12 in. or less. *Cymes* terminal, 2-5-flowered, ultimately lax or flowers solitary; peduncles filiform, .4-8 in. long; pedicels very slender, about .08 in. long. *Calyx* slender, obconical-oblong, .15-2 in. long; teeth triangular, broad, acute. *Petals* elliptic, cuspidate, about .33 in. long, pink. *Anthers* shortly acuminate, .12-17 in. long. *Style* filiform, .2 in. long; stigma punctiform. *Fruit* oblong, subtrigonus, smooth, .25-3 in. by .08-1 in.

PERAK; Gunong Batu Pateh, 4300 ft., *Wray* 1022!

3. *SONERILA HYSOPIFOLIA*, Stapf and King. An erect, simple or branched herb, 6-9 in. high, with two lines of short, curled hairs on the stem and branches, and with whitish, flexuous, longer hairs on the upper side of the leaves. *Stem* subterete below, quadrangular above. *Leaves* sessile or petioled, those of a pair similar in shape and size, lanceolate, subacute, cuneate at the base or the uppermost sessile and rounded at the base, symmetrical, minutely and somewhat remotely toothed with very acute or mucronate teeth, membranous, green, pale below, 1-1.75 in. by .15-3 in., indistinctly 3-nerved from near the base; petioles very variable in length, up to .4 in. long, or 0. *Cymes* few-flowered, at length lax; peduncles .8-1 in. long, very slender, pedicels very slender, .04-08 in. long. *Calyx* very slender, almost cylindrical, .24-28 in. by .04 in.; teeth triangular, mucronulate. *Petals* elliptic-oblong, acute, .27 in. long, pink. *Anthers* acuminate, .12-18 in. long. *Style* filiform, about .18 in. long; stigma subcapitate. *Fruit* trigonus-cylindric, slightly obconical at the base, .5 in. by almost .1 in.

PERAK; Gunong Hijan; *Scortechini* 1426!

4. *SONERILA ERECTA*, Jack in Malay Misc. I, 7. A copiously branched herb, 1-1.5 ft. high, more or less hairy with the exception of the inflorescence, hairs flexuous, finely pointed, those of the stem and branches short, along 2 lines, those of the leaves longer, whitish, all over both surfaces. *Stem* subterete below, quadrangular above,

branched all along, branches more or less divaricate, 1 or, in luxuriant specimens, 2 from each leaf axil; often branched again. *Leaves* sessile or petioled, often apparently whorled on the upper or, in vigorous specimens, almost on all nodes, those of a pair similar in shape and size, lanceolate or ovate, acute or subacute, contracted or subcuneate at the base, rather symmetrical, entire or minutely toothed, membranous, green or greyish when very hairy, .4–1.2 in. by .2–.4 in., indistinctly 3-nerved from near the base; petioles slender, very variable in length, up to .3 in. long, or 0. *Cymes* 2–9-flowered, at length very lax; peduncles filiform, .4–2 in. long; pedicels very slender, .04 in. long or hardly any. *Calyx* very slender, almost cylindrical, .15–.2 in. by .03 in., teeth triangular, short. *Petals* elliptic-oblong, cuspidate-acuminate, .15 in. long, pink. *Anthers* ovate-lanceolate, acute or subacute, .06–.09 in. long. *Style* filiform, .12 in. long; stigma punctiform. *Fruit* almost cylindrical, slightly trigonous, smooth, .3–.45 in. by .06–.08 in. Jack in Hook. Bot. Misc. II, 63; Blume in Flora (1831), 491; Benn. Pl. Jav. Rar. 217; Naud. in Ann. Sc. Nat. Ser. 3, XV, 324; Miq. Fl. Ind. Bat. I, 563; Triana in Trans. Linn. Soc. XXVIII, 75; C. B. Clarke in Hook. f. Fl. Brit. Ind. II, 530; Cogn. in DC. Monogr. VII, 492; Stapf in Ann. Bot. VI, 304.

PENANG; Government Hill, *Curtis*, *Porter* in Wall. Cat. 4092; *Maingay* 2214 (778, Kew Distrib.). DISTRIB. Northwards as far as Moulmein.

VAR. *flexuosa*, Stapf and King. *Stems* ascending, like the very slender branches more or less flexuous. *Leaves* lanceolate to linear-lanceolate, acuminate at the base, .4–.8 in. by .12–.2 in., more or less pubescent or scaberulous from very short hairs, mainly above, margins usually finely but sharply toothed and often revolute. *Cymes* 3–1-flowered with capillary peduncles. *Fruit* .27–.35 in. long, by .6–.8 in.

PENANG; on rocks, 2000 ft., *Curtis* 1238! PERAK; Larut, on rocks in rich, moist soil, 300 to 600 ft., *Kunstler* 2364! *Scortechini* 91!

VAR. *discolor*, Stapf and King. *Stems* ascending or erect, branches very slender, slightly flexuous, very minutely hairy along lines or almost glabrous. *Leaves* oblong-lanceolate to ovate-lanceolate, minutely toothed, narrowly revolute on the margins, very pale beneath, 3–5-nerved near the base, nerves fine, but rather distinct. *Cymes* 4–1-flowered, rather congested, also when mature. *Anthers* .08–.09 in. *Fruit* oblong-cylindrical, .3–.35 in. by .08 in.

PERAK; *Scortechini* 160!

5. *SONERILA TENUIFOLIA*, Blume in Flora 1831, 491. An erect or ascending, branched or unbranched herb, 6–12 in. high, usually with scattered, spreading, gland-tipped hairs in the upper part of the stem, on the peduncles and pedicels, and near the mouth of the calyx and with few

adpressed, finely attenuated, pale hairs on the upper side of the blades, rarely almost quite glabrous. *Stem* slender, terete below, more or less quadrangular upwards. *Leaves* of a pair similar in shape, but unequal in size, ovate to ovate-lanceolate, long acuminate, symmetrical or slightly asymmetrical and rounded at the base, acutely and coarsely toothed, thinly membranous, dark- or pale-green, the larger 1-2 in. by .4-1 in., distinctly 3-, rarely 4-5-nerved from the very base, very faintly pinnate-nerved higher up; petioles very slender, reaching 1.5 in. in length, purple. *Cymes* 1-6-flowered, almost pseudo-umbellate; peduncle .5-1 in. long, like the slender pedicels purple or crimson, the latter .25-.3 in. long. *Calyx* campanulate-oblong to ovoid-oblong, about .15 in. long; teeth distinct, triangular. *Petals* elliptic, apiculate, .3-.35 in. long, glabrous, rose-coloured. *Anthers* lanceolate-acuminate, acute or sub-obtuse, .12-.13 in. long. *Stigma* capitate. *Fruit* trigonous, obconical, .23-.27 in. long, smooth; valves .23 in. broad. *Benn. Pl. Jav. Rar.* 211, t. 44; *Nand. in Ann. Sc. Nat. ser. 3, XV,* 324; *Miq. Fl. Ind. Bat. I,* 563. *Triana in Trans. Linn. Soc. XXVIII,* 76; *C. B. Clarke in Hook. f. Fl. Brit. Ind. VIII,* 536. *Stapf in Trans. Linn. Soc. 2nd Ser. IV,* 156; *Cogn. in DC. Monogr. VII,* 502; *Stapf in Ann. Bot. VI,* 301.

PERAK; *Scortechini* 312! *Kunstler* 722! *Wray* 427! on Gunong Batu, 4500 ft., *Wray* 273! 406. MALACCA; Mt. Ophir, *Maingay* 2582! *DISTRIB.* Sumatra, Java, Borneo.

*VAR. hirsuta*, *Stapf and King.* Leaves hairy on both sides; hairs copious at least above, longer, wavy or curled, less adpressed than in the type; blades often very small (0.6 in. by 0.3 in.); flowers solitary.

PERAK; *Scortechini* 790! *Larut*, top of Gunong Bubu, 5000-5300 ft., *Kunstler* 7406! *Wray* 3841!

6. *SONERILA FLACCIDA*, *Stapf and King.* An erect or ascending, usually branched herb, .5-1 ft. high, with a very fine, furfuraceous, dark rusty and often scanty indumentum in the lower part and on the under-side of the leaves (at least on the nerves), otherwise glabrous. *Stem* quadrangular. *Leaves* of a pair similar, equal or unequal in size, oblong or oblong-elliptic, subacute or subacuminate at both ends, or the tips obtuse, sometimes decurrent at the base, entire or nearly so, symmetrical or more or less asymmetrical, thinly membranous, dark- or light-green and often spotted with white circular or elliptic spots above, whitish green beneath, 2-4 in. by .75-1.75 in., pinnate-nerved, distinct side-nerves usually 3 on each side, the others like the tertiary nerves very faint or quite obscure; petiole up to .6 in. long, often very short, slender. *Cymes* terminal and axillary, short, few- to 9-flowered, peduncled, peduncle very slender, .75-1 in. long; pedicels very slender, .08-.15 in. long. *Calyx* slender, obconical to oblong, .13-.15 in. long, rose-coloured, teeth triangular, very short and broad. *Petals* oblong, acute, .15 in.

long, rose-coloured. *Anthers* acute, .12 in. long. *Style* filiform; stigma capitate. *Fruit* trigonous, truncate-obovate, .2 in. long, smooth; valves .12 in. broad.

PERAK; Gunong Panti, 600–800 ft., *Kunstler* 219! *Ridley* 4184! Gunong Inas, 3500 ft., *Wray* 4066! 4067!

Certain small specimens, collected by Scortechini in Perak (272), represent only a dwarf state of *S. flaccida*; their larger leaves measure 1–1.5 in. by .6–.8 in.

7. *SONERILA ANDAMANENSIS*, Stapf and King. An erect or ascending, branched or unbranched herb, 3–6 in. high, more or less hirsute, particularly on the stem and petioles, with flexuous, finely pointed hairs. *Stem* reddish-brown when dry, quadrangular. *Leaves* rather approximate, those of a pair similar in shape and size, or more or less unequal, ovate to ovate-oblong, acute or subacuminate, rounded or subcordate and often slightly asymmetrical at the base, membranous, green or purple above, purplish glaucous below, length 1.5 to 3.3 in., breadth 1 to 1.7 in., 5–8-nerved from below the middle, the lower nerves more or less opposite, the uppermost 1 or 2 usually alternate, transverse veins oblique, fine or obscure; peduncle .5–1.5 in. long. *Cymes* few- to many-flowered, much contracted, peduncles solitary and terminal, or 2–4 from the top and the uppermost leaf-axils, 1–2 in. long; pedicels slender, up to .1 in. long, like the flowers with scanty and sometimes minutely gland-tipped hairs. *Calyx* very slender, obconical, up to .2 in. long; teeth short, broad, triangular. *Petals* elliptic, acuminate, .25 in. long, rose-coloured. *Anthers* ovate-lanceolate, subacute, .09–.12 in. long. *Style* filiform, .2–.25 in. long; stigma capitate. *Fruit* oblong with a cuneate base, .22–.27 in. long, smooth; valves scarcely .1 in. broad.

ANDAMANS; Mount Harriet near Port Blair, on rocks, *King's Collector* 48!

8. *SONERILA POPULIFOLIA*, Stapf and King. An erect or ascending, simple or sparingly branched herb, 6–9 in. high, more or less covered with minute hairs and with a few soft, adpressed, whitish, small bristles on the surface and the margins of the ultimately often glabrescent leaves, with the hairs of the inflorescence often minutely gland-tipped. *Stem* finely rusty-tomentose, subterete below, quadrangular above. *Leaves* of a pair similar in shape and equal or somewhat unequal in size, ovate, acute or acuminate, usually minutely cordate at the base, with the lobes often more or less unequal and close, subentire or toothed in the upper part, thinly membranous, light-green, 1.5–3 in. by 1.2–1.75 in., finely 7-nerved from near the base, upper pair .2–.3 in. from the base; petioles very slender, 1–2 in. long, finely tomentose. *Cymes* few- to 12-flowered, much contracted and almost umbelliform, terminal; peduncle slender, .5–1.2 in. long; pedicels slender, .15–.22 in. long.



*Oalyx* subcampanulate-oblong, .18-.2 in. long; teeth broad, triangular. *Petals* elliptic, shortly acuminate, .3-.4 in. long, deep- to blueish-pink. *Anthers* acuminate, tips sometimes very fine and curved, .2-.3 in. long. *Style* filiform, .35-.45 in. long; stigma minutely capitate. *Fruit* trigonous, truncate-obovoid, .2-.25 in. long, smooth, often finely puberulous; valves .15-.16 in. broad.

PERAK; *Scortechini* 136! 300-500 ft., *King's Coll.* 10055! Larut, dense jungle, 500-800 ft., *King's Coll.* 5791! Briaiah plains, *Wray* 4201! Tapah, *Curtis*!

The uppermost pair of leaves is often much reduced, resembling a pair of bracts. One of the leaves of the preceding pair is sometimes suppressed, whilst the peduncle and the petiole of the other leaf are so turned that the latter seems to form the continuation of the axis; hence the former appears to spring from a long petiole. This is chiefly the case with the inflorescences which terminate branches.

9. *SONERILA PALLIDA*, Stapf and King. An ascending, branched or unbranched herb, 6-12 in. high, hirsute all over, but chiefly on the stems and petioles, hairs pale reddish when dry, those of the inflorescence short, stiff and spreading. *Stem* decumbent at the base, rooting in the lower part, quadrangular. *Leaves* of a pair similar in shape, but usually rather unequal in size, oblong to ovate-oblong, acuminate, symmetrical or more or less asymmetrical and acute (rarely obtuse) at the base, minutely denticulate, membranous, light green, the larger 1.5-4 in. by .8-1.8 in., finely but distinctly 5-7-nerved from near the base, the upper pair .4-.6 in. from the base, petioles up to .6-.75 in. long. *Oymes* few- to 8-flowered, short, on apparently terminal peduncles; peduncles slender, 1-2 in. long; pedicels .08-.15 in. long, slender. *Oalyx* slender, trigonous, obconical-campanulate, .15-.2 in. long; teeth distinct, triangular. *Petals* elliptic-oblong, apiculate, .45-.5 in. long, with a line of short, stiff, spreading hairs on the back, pale pink. *Anthers* acuminate, slender, .23-.24 in. long. *Style* filiform, stigma punctiform. *Fruit* trigonous, obconical, .25-.3 in. long, sparingly muricate, valves .15 in. broad.

PERAK; Gunong Inas, 5000 ft., *Wray* 4100! MALACCA; Bujong, *Curtis* 3155! SELANGORE; Bukit Hitam, 2500-3500 ft., *Kelsall*! *Ridley* 7320!

10. *SONERILA RUDIS*, Stapf and King. A semidecumbent, sparingly branched or unbranched herb, about 1 ft. high, densely clothed with short, or often very long, fine and spreading, curved or curled hairs on the stem and petioles, with somewhat coarse, more or less adpressed hairs on both sides of the leaves and gland-tipped, spreading hairs on the peduncles, pedicels, calyx and the midrib of the petals, hairs reddish when dry. *Stem* often rooting in the lower part, terete or subquadrangular

in the upper part. *Leaves* of a pair similar, subequal or rather different in size, ovate to oblong or elliptic, acute or subacuminate, rounded at the base, entire, somewhat fleshy, green above, pale beneath, distinctly 7-nerved from near the base (upper pair .2-.25 in. above the base); petioles .4-1.2 in. long. *Cymes* 2-6-flowered, umbelliform, terminal, peduncled; peduncle slender, .5-1 in. long; pedicels .08-1 in. long. *Calyx* rather slender, subcampanulate, .12-.15 in. long; teeth short, broad, triangular. *Petals* elliptic to obovoid, obtuse or subacute, .5-.6 in. by .35-.4 in., pink, with a line of gland-tipped hairs on the back. *Anthers* acuminate, slender, .23-.27 in. long. *Style* filiform; stigma punctiform. *Fruit* trigonous, shortly obconical, about .27 in. long, muricate, on stout muricate pedicels; valves .2 in. broad.

PERAK; *Scortechini!* Tumbung Parbat, *Scortechini* 422! Gunong Batu Pateh, 4500 ft., Wray 260. MALACCA; Bujong, *Curtis* 3297!

11. *SONERILA MOLLIS*, Stapf and King. An ascending, sparingly branched or unbranched herb, about 1 ft. high, densely and adpressedly tomentose along stem and petioles, and on the underside of the leaves along the nerves, and besides almost cobwebby on both sides of the young leaves; all the hairs soft and reddish when dry. *Stem* often rooting in the lower part, terete or subquadrangular in the upper part. *Leaves* of a pair similar, but differing more or less in size, elliptic to ovate-elliptic, shortly and acutely acuminate, rounded at the base, entire, somewhat fleshy, very dark green and quite glabrous above when adult, pale and glabrescent beneath between the nerves, the larger 2-3 in. by 1-2 in., distinctly 5-7-nerved from near the base (upper pair of side nerves .25-.27 in., distant from the base); petioles .4-1 in. long. *Cymes* 2-4-flowered, umbelliform or flowers solitary, terminal, peduncled, glabrous; peduncle about .5 in. long, slender; pedicels .2-.24 in. long, very slender. *Calyx* slender, subcampanulate, .18-.2 in. long; teeth very short and broad, triangular. *Petals* elliptic-oblong, acute, .4 in. long. *Anthers* acuminate, .2-.22 in. long. *Style* filiform; stigma punctiform. *Fruit* trigonous, shortly obconical, .24 in. long, smooth; valves .2-.24 in. long.

PERAK; Wray, *Scortechini!* Summit of Gunong Batu Pateh, 6700 ft., Wray 375!

12. *SONERILA ALBIFLORA*, Stapf and King. An ascending or suberect, more or less branched herb, 9-12 in. high, densely and adpressedly hirsute along stem and petioles and more sparingly on the underside of the leaves, and with gland-tipped spreading hairs on pedicels, calyx and midrib of petals. *Stem* rather slender, terete or subquadrangular in the upper part. *Leaves* of a pair similar and rather equal in size, lanceolate to ovate- or obvate-lanceolate, acute or subacuminate at both ends, entire or almost so, fleshy, very dark green (almost black when

dry) and glabrous above, pale and adpressedly hairy beneath (at least on the nerves), 1-3 in. by .5-1.25 in., distinctly 3-5-nerved from near the base; petioles .2-4 in. long. *Flowers* axillary and terminal, solitary or paired; pedicels .1-2 in. long, slender. *Calyx* subcampanulate, ovoid, .1 in. long; teeth distinct, broadly triangular. *Petals* oblong, apiculate, .2 in. long, white, with a line of gland-tipped hairs beneath. *Anthers* oblong, obtuse, .08-1 in. long. *Style* slightly and gradually thickened upwards; stigma punctiform. *Fruit* trigonous, shortly obconical, .2 in. long, very scantily muriculate; valves .2 in. broad.

PERAK; *Scortechini* 1886! Gunong Kledang, 1000 ft., *Curtis* 3293! *Ridley* 9691! *Goldham*! Kinta in dense jungle, 3500-4000 ft., *King's Collector* 7169!

13. *SONERILA LASIANTHA*, Stapf and King. An erect herb, 4-6 in. high, hirsute all over with flexuous, finely pointed, rufous hairs. *Stem* terete, with the hairs more or less adpressed. *Leaves* of a pair similar in shape, very unequal in size, obliquely lanceolate or subovate, acute, attenuated at the base, membranous, green above, pale beneath, the larger 1.5-3 in. by .6-8 in., with 2-3 side-nerves in the broader and 1 in the narrow half, the uppermost .75-1 in. above the base; petiole slender, .3-6 in. long. *Fascicles* few-flowered, terminal and axillary, subsessile; pedicels rather stout, .1-1.5 in. long. *Calyx* obconical, densely hirsute, .15-1.8 in. long. *Petals* oblong, cuspidate-acuminate, .12 in. long. *Anthers* oblong, subacute, .06 in. long. *Style* filiform, rather stout; stigma punctiform. *Fruit* broad, obconical, muricate, to .25 in. long; valves .18-2 in. broad.

PERAK; Gunong Babu, *Wray* 3863! (in part).

The specimen which we have here in view is so different in habit and in the size of the comparatively long peduncled leaves from the others bearing the same number in *Wray's* collection, but described under *S. suffruticosa*, that we believe ourselves justified in considering it for the present as a distinct species.

14. *SONERILA SUFFRUTICOSA*, Stapf and King. An erect, repeatedly branched half-shrub, over 1 ft. high, shaggy all over from coarsely adpressed, crimson (reddish, when dry) hairs, or glabrescent at length at the base. *Stem* terete, woody below, hollow. *Leaves* mainly crowded near the tips of the branches, those of a pair similar in shape, but rather unequal in size, oblong to ovoid-oblong, acute, more or less asymmetrical or almost symmetrical and acute at the base, obscurely serrate or toothed, thickly membranous, dark green above, paler beneath, the larger 1-1.4 in. by .4-6 in., 3-5-nerved from near the base; petioles .25 in. long to very short. *Flowers* unknown (petals white according to *Wray*). *Fruits* axillary, solitary or in pairs on stout short pedicels, obconical, .2 in. long, strigose from tubercle-based hairs, or muricate from their persistent bases; valves .12 in. broad.

PERAK; Larut, Gunung Bubu, 5000 ft., *Wray* 3863! (in part).

15. *SONERILA ELLIPTICA*, Stapf and King. An erect or ascending, usually unbranched herb, 6–9 in. high, with a very fine, furfuraceous, dark-rusty indumentum in the lower parts and on the young leaves, glabrous or soon glabrescent higher up. *Stem* somewhat stout and succulent, terete. *Leaves* of a pair similar in shape, slightly unequal or equal in size, broadly elliptic, rarely ovate or almost orbicular, very obtuse, usually symmetrical and rounded or subcordate at the base, minutely and inconspicuously toothed, thick, fleshy, dark-green, often mottled with white along the nerves above, waxy yellowish-green beneath, 1–2.5 in. by .75–2 in., distinctly 5-nerved from the very base, upper nerves usually quite indistinct; petioles 1–2 in. long. *Cymes* many-flowered, dense, axis at length up to .75 in. long; peduncle slender, 1–2.5 in. long, pedicels at length up to .2 in. long. *Calyx* obconical, trigonous, .12 in. long, glabrous, teeth distinct, broad, triangular. *Petals* oblong, apiculate, .2–.23 long, glabrous, pinkish white. *Anthers* oblong, obtuse, scarcely .1 in. long. *Stigma* punctiform. *Fruit* trigonous, obconical, .15 in. long, smooth; valves .12 in. broad.

PERAK; Kinta, on limestone rocks, 500–800 ft., *Kunstler* 7037! 7225! *Sungie Siput*, *Curtis* 3156!

16. *SONERILA SUCCULENTA*, Stapf and King. A succulent, erect herb, quite glabrous with the exception of a very few gland-tipped hairs on the calyx. *Stem* stout, very short to 3 in. long, very fleshy. *Leaves* few, crowded, of a pair equal, symmetrical or almost so, long-petioled, elliptic to ovate-elliptic, rather long and acutely acuminate, rounded at the base or very slightly subcordate, entire, very thinly membranous when dry, 6–7 in. by 3–4 in., 7-nerved from the base, with lax, subhorizontal transverse nerves, petioles succulent, 2–4 in. long. *Cymes* terminal and axillary, 2–5 on a long common peduncle, subbracteate, rather few-flowered, very short and dense; common peduncle stout, 4–7 in. long; special peduncles 1 to over 3 in. long, bracts very minute, subulate, the lower soon deciduous; pedicels hardly any. *Calyx* oblong-campanulate, up to .25 in. long; teeth short, triangular. *Petals* oblong, cuspidate-acuminate, .18 in. long. *Anthers* long-acuminate, incurved, over .25 in. long. *Style* .35 in. long; stigma subcapitate. *Fruit* subtrigonous, obconical, smooth, up to .25 in. long; valves over .15 in. broad.

PERAK; Maxwell's Hill, 3000 ft., *Scortechini* 279!

17. *SONERILA REPENS*, Stapf and King. A herb with a long creeping rhizome and a very short succulent stem bearing 2–3 usually much approximated pairs of leaves, with few, whitish, more or less adpressed, papilliform hairs on both sides of the leaves and with very few, minute, gland-tipped hairs on the stems, petioles and inflorescences, or glabrous with the exception of the leaves. *Leaves* of a pair similar in shape,

equal or, more usually, very unequal in size, ovate, rarely oblong, acutely acuminate, cordate, rounded or rarely subacute at the base, rather symmetrical, entire or slightly wavy and denticulate, thinly membranous, dark- or pale-green, the larger 3-7 in. by 2-4.5 in., distinctly 7-nerved from the very base, with somewhat distant transverse veins; petioles 1-2.5 in. long, slender or stout, fleshy. *Cymes* long-peduncled, often many-flowered, solitary or usually 2-4 on a common subterminal peduncle from the leaf axils or close to the top; peduncle 2-5 in. long, first slender, at length rather stout, pedicels slender, .1-1.2 in. long. *Calyx* slender, obconical-campanulate, .2 to .23 in. long; teeth triangular. *Petals* elliptic, acute, .2-.25 in. long, white or greenish white. *Anthers* slender, acuminate, .23-.27 in. long. *Style* filiform; stigma punctiform. *Fruit* trigonous, obconical with straight sides, .22-.3 in. long, smooth; valves .15-.16 in. long.

PERAK; 2000-4000 ft., common, *Curtis* 2015! *Scortechini* 1911! Maxwell's Hill, *Scortechini* 18/a! *Ridley*! Larut, on rocks in dense jungle, 2000 ft., *Kunstler* 2005! in open jungle on hill sides, 500-800 ft., *King's Collector* 5152! Kinta, *Curtis*! MALACCA; Bujong, 3000 ft., *Curtis*!

18. *SONERILA MUSCICOLA*, Stapf and King. A flaccid, ascending, unbranched herb, 4-6 in. high, with a creeping rhizome, with pale, fine, curved or curled hairs in the upper part of the stem and the leaves, and with scanty, gland-tipped hairs on the pedicels, calyx and on the back of the petals. *Stem* slender, weak, quadrangular. *Leaves* of a pair similar in shape and size, oblong to lanceolate-oblong, subacute or subacuminate at both ends, symmetrical or almost so, minutely toothed or almost entire, thinly membranous, pale-green, 2-3.7 in. by .8-1.4 in., pinnate-nerved, nerves 3-4 on each side, fine, very oblique; petiole .3-.8 in. long. *Cymes* few-flowered, terminal, peduncled, umbelliform, peduncles very slender, 1-1.5 in. long; pedicels very slender, .08-.12 in. long. *Calyx* slender, obconical-campanulate, .2 in. long; teeth triangular, broad. *Petals* elliptic, apiculate, .35-.4 in. long, pink, with a few gland-tipped hairs along the middle nerve beneath. *Anthers* very slender, acuminate, tips curved, .22-.24 in. long. *Style* filiform; stigma punctiform. *Fruit* trigonous, truncate-obovoid, .2 in. long, smooth; valves .12 in. broad.

KEDAH; Gunong Raya, on mossy trees, *Curtis* 2573!

19. *SONERILA SAXOSA*, Stapf and King. An erect, delicate herb, 2-4 in. high, scantily hairy with the exception of the glabrous flowers, hairs pale, flexuous with long, fine tips; with a slender, creeping rhizome. *Stem* very slender, quadrangular. *Leaves* in 3-4 pairs (of which the upper are rather close), those of a pair similar in shape and size, oblong-lanceolate to lanceolate, acute at both ends, rather symmetrical,

finely toothed in the upper part or almost entire, membranous, green above, purplish beneath, '8-1.7 in. by '3-6 in., 5-7-nerved from below the middle; petiole '2-3 in. long. *Cymes* 4-7-flowered, much contracted, terminal; peduncles very slender, '5-1.5 in. long; pedicels very slender, '15 in. long, glabrous. *Calyx* very slender, linear-subcampanulate, '15 in. long, teeth broad, triangular. *Petals* elliptic, acuminate, cuspidate, '3-35 in. long, pink. *Anthers* acuminate, '19 in. long. *Style* filiform, '3 in. long; stigma punctiform. *Fruit* obconical, truncate, sides almost straight, passing into the thickened pedicel, '25 in. long; valves '12-15 in. broad.

PENANG; Government Hill, 2500 ft., on rocks in damp shady ravines; *Ourtis*!

20. *SONERILA CONGESTA*, Stapf and King. An erect or suberect, rather delicate herb, 3-3.5 in. high, quite glabrous with the exception of an extremely scanty, furfuraceous, dark-rusty indumentum in the lower part; with a slender, creeping rhizome. *Stem* 1-1.5 in. long (exclusive of the peduncle), quadrangular. *Leaves* in about 3 crowded pairs, those of a pair similar in shape and size, broad, ovate to elliptic, obtuse or subobtuse, rounded or obscurely cordate at the base, rather symmetrical, subentire, thinly membranous, green, '9-1.7 in. by '6-1.2 in., 5-7-nerved from near the base, upper pair '4-6 in. from the base; petiole slender, '6-7 in. long. *Cymes* 4-9-flowered, contracted; peduncles slender, 1.2 in. long; pedicels slender, '12-15 in. long. *Calyx* slender, subcampanulate-oblong, '15 in. long; teeth triangular, short. *Petals* elliptic-oblong, cuspidate-acuminate, '35 in. long, pink. *Anthers* acuminate, '15-2 in. long. *Style* filiform, '25-3 in. long; stigma punctiform. *Fruit* (semimature) obovoid-oblong, '15 in. long.

KEDAH; Gunong Chinchang, *Ourtis* 2572!

21. *SONERILA GRIFFITHII*, C. B. Clarke in Hook. f. Fl. Brit. Ind. II, 539. An ascending, delicate herb, quite glabrous with the exception of the margins and sometimes the upper surface of the leaves; with a rather stout rhizome. *Stems* very slender, 2-3 in. long (exclusive of the panicle), rooting from the lower, soon leafless nodes, quadrangular. *Leaves* in 3-4, often crowded pairs, those of a pair similar in shape and size, broad, ovate to rotundate-elliptic, obtuse or subobtuse, obscurely cordate, rarely subobtuse at the base, rather symmetrical, toothed and ciliate on the margin, membranous, green, '4-8 in. by '4-6 in., 5-nerved from near the base, upper pair '1 in. from the base; petioles slender, '3-5 in. long. *Cymes* 2-3-flowered, much contracted, peduncles slender, 1-2.2 in. long; pedicels very slender, '1 in. long. *Calyx* slender, subcampanulate-oblong, '12 in. long; teeth triangular-ovate. *Petals* elliptic-oblong, cuspidate-acuminate, scarcely '25 in. long, pink. *Anthers* acuminate, '12-15 in. long. *Style* filiform, not quite '25 in. long; stigma

punctiform. *Fruit* truncate, obovoid-oblong, cuneate at the base when quite ripe, .19–.23 in. long, obtusely trigonous. Cogn. in DC. Mon. VII, 513; Stapf in Ann. Bot. VI, 308.

MALACCA; Mt. Ophir, on dripping places, *Griffith* 2300! *Mainingay* 2583! *Lobb* 182.

22. *SONERILA CYCLAMINELLA*, Stapf and King. A rather delicate, perfectly glabrous, almost acaulescent herb, with a creeping rhizome. *Stem* usually extremely short, quadrangular. *Leaves* in about 4 pairs, almost crowded into a rosette, those of a pair similar in shape and size, ovate to oblong-obtuse or subobtuse at both ends or subcordate at the base, rather symmetrical, undulate-crenulate or almost entire, membranous, light or dark brownish green above with silvery bands along the midrib and often also along the side, nerves more or less rich violet underneath, .8–1.4 in. by .4–.6, distinctly although finely 5–7-nerved below the middle, often with 1 or 2 delicate side-nerves higher up; petioles slender, .4–1 in. long. *Oymes* 2–5-flowered, very much contracted; peduncles slender, 2–5 in. long, pedicels slender, .08–.1 in. long. *Oalyx* slender, subcampanulate-oblong, .12–.15 in. long; teeth triangular, short. *Petals* elliptic, cuspidate-acuminate, scarcely .25 in. long, light pink. *Anthers* acuminate, .12 in. long. *Style* filiform, .25 in. long; stigma minutely subcapitate. *Fruit* truncate, obovoid, obtusely trigonous, .12–.16 in. long.

PERAK; on rocky hilltops, 800–1000 ft., *King's Collector* 10745! 10746! 10744 (in part)!

VAR. *canescens*, Stapf and King. Leaves more or less covered above with long, flexuous, white hairs; some of Ridley's specimens have leaves up to 3 in. by 1.2 in.

PERAK; with the type; *King's Collector* 10744 (in part)! SELANGORE; Bukit Kinta, 3000 ft., on rocks, *Ridley* 7318!

23. *SONERILA HETEROSTEMONA*, Naud. in Ann. Sc. Nat. Ser. 3, XV, 326, t. XVIII, fig. 4. An erect or ascending, often branched herb, .5–2 ft. high, rarely quite dwarf, quite glabrous apart from an extremely fine, furfuraceous, rusty indumentum in the younger parts and, occasionally, a few scattered, short, whitish hairs on the upper surface of the leaves. *Stem* somewhat stout, quadrangular. *Leaves* of a pair similar in shape, but usually very unequal or one arrested at a very early stage or quite suppressed, rarely both more or less equal, usually conspicuously asymmetrical, obliquely ovate, subacute or shortly acuminate, rounded or shortly narrowed at the base, minutely toothed, membranous, metallic green, often spotted above, purplish beneath on the nerves, 1.5–4.5 in. by 1–2.3 in., 5–6-nerved from the very base with fine, lax, more or less horizontal transverse veins; petioles very unequal in length, .5–2 in. long. *Oymes* axillary and terminal, much contracted

and compact, very many-flowered, distinctly bracteate, at length 1-2.5 in. long, peduncle .6-1.2 in. long; bracts spatulate or obovate, very obtuse, up to .2 in. long, persistent; pedicels hardly any. *Calyx* short, obconical-oblong, .15-.16 in. long; teeth obscure, very obtuse. *Petals* elliptic, obtuse, pink, .15 in. long. *Stamens* 6, 3 slightly curved, purple, .15 in. long, 3 straight or almost so, yellow, .12-.15 in. long. *Fruit* subsessile, turbinate, .19-.23 in. long; valves .19 in. broad. *Miq.* Fl. Ind. Bat. I, 565; Triana in Trans. Linn. Soc. XXVIII, 77; C. B. Clarke in Hook. f. Fl. Brit. Ind. II, 540. *S. obliqua*, Cogn. in DC. Monogr. VII, 515; and Stapf in Ann. Bot. VI, 310 (in part), not of Korth.

PERAK; *Scortechini!* Ipoh, Curtis 3158! Changkal Serdang, Wray 783! Larut, *Scortechini* 54/a! Goping, Kunstler 787! Tapa, Wray 1308. MALACCA; Griffith 2302! 2294! Maingay 1223! (782, Kew Distr. partly), Cuming 2349! Lobb 183! in dense forest between Jassing and Ayer Bombon, Maingay 1425! (782, Kew Distrib. partly). MALACCA; Batang, Holmberg 876! Ulu Gajah, Harvey! (dwarf specimens). SINGAPORE; Maingay 3098! (782, Kew Distrib. partly); Bukit Timah, Hullet 893! PAHANG; Tahan, Ridley! (dwarf specimens). **DISTRIB.** Sumatra to Borneo.

24. *SONERILA INTEGRIFOLIA*, Stapf in Ann. of Bot. VI, 312. An erect or ascending, simple or branched herb, .5-1.3 ft. high, rufously strigose on the stem, the petioles, the nerves on the underside of the leaves and the inflorescence, including the calyx, but exclusive of the bracts, hairs of the leaves very tightly adpressed, like those of the inflorescence very short. *Stem* rather robust, often swollen at the nodes, subflexuous, almost woody below. *Leaves* very dissimilar, the larger of a pair asymmetrical, rarely symmetrical, usually obliquely oblong-lanceolate to obovate-oblong, distinctly (sometimes long) acuminate, minutely cordate or acute at the base, entire, sometimes with slightly wavy margins, somewhat fleshy, soft, quite glabrous above, dark- or yellowish-green, 3-5 in. by 1-1.5 in., sub-5-nerved from near the base with the lowermost pair of nerves faint, and the uppermost (in the narrow half) .2-1.2 in. above the base, with fine oblique transverse veins; small leaves minute, ovate to rotundate, often cordate, sessile or shortly petioled. *Cymes* terminal and apparently leaf-opposed, peduncled, bracteate, few- to many-flowered, very dense, up to 1 in. long, peduncles very short to .5 in. long; rachis often flexuous when long; bracts oblong to linear-lanceolate, fleshy, up to .12 in. long, often much smaller, sometimes extremely numerous and crowded; pedicels very short or 0. *Calyx* oblong-campanulate, nearly .1 in. long; teeth triangular, up to .04 in. long, acute. *Petals* oblong, acute, .15 in. long, white to pink. *Anthers* oblong, obtuse, almost .1 in. long. *Style* .2 in,



long; stigma punctiform. *Fruit* semiglobose-turbinate, .12-.18 in. long and wide, bullate-muricate.

PERAK; Larut, 200-800 ft., *Kunstler* 1917! 2791! Changkal Serdang, *Wray* 755! Blanda Mobok, *Wray* 3954! Maxwell's Hill, *Scortechini* 16a! Hermitage, *Curtis* 1302! SELANGOR; Dusun Tua, *Ridley* 7334! Kwala Tampan Caves, *Ridley* 306!

VAB. *acuminatissima*, Stapf and King. Leaves mostly very long and finely acuminate, on the whole narrower and less asymmetric than in the type, margins often slightly wavy to remotely serrulate, not rarely with a row of white spots close to them. *Petals* white.

PERAK; Larut, 1800-4000 ft., in dense old jungle, *Kunstler* 2004! 2161!

25. *SONERILA BRACTEATA*, Stapf and King. An erect or ascending, unbranched or very scantily branched herb, .5-1.5 ft. high, softly and densely hirsute to tomentose from rufous, flexuous or curved, more or less spreading, fine hairs in all parts with the exception of the upper side of the leaves which is glabrous apart from scattered, adpressed, pale bristles. *Stem* rather stout below with swollen nodes, subflexuous, leafy part 2 to over 6 in. long. *Leaves* very dissimilar, the larger of a pair shortly petioled, somewhat asymmetrical, oblanceolate, long and finely acuminate, unequally cordate at the base with a small rounded lobe on the outer, and a still smaller or obscure lobe on the inner side, entire, ciliate along the margin, membranous, light-green, 3-7 in. by 1-1.7 in., 5-nerved from near the base (the uppermost nerve .5-1.5 in. above the base), with oblique, transverse veins; petioles .2 to .4 in. long; small leaves reniform, very minute or up to .3 in. in diam. *Cymes* terminal and axillary, long-peduncled, very dense, subcapitate at first, at length to 1.5 in. long, multibracteate, many-flowered; peduncle rather slender, up to 2 in. long; bracts linear, membranous, ciliate, up to .12 in. long; pedicels very short. *Calyx* shortly oblong-campanulate, .07-.08 in. long; teeth lanceolate-triangular, about .04 in. long. *Petals* oblong, cuspidate-acuminate, white, .08 in. long, with a line of gland-tipped hairs on the back. *Anthers* short, oblong, obtuse, .06-.07 in. long. *Style* .15 in. long; stigma punctiform. *Fruit* shortly turbinate, .15 in. long and wide, densely muricate.

PERAK; Larut, in dense old jungle, 3200-3500 ft., *Kunstler* 2133! Maxwell's Hill, *Scortechini* 12!

26. *SONERILA CAPITATA*, Stapf and King. An ascending, unbranched or scantily branched herb, 3-12 in. high, rufously strigillose on the stem, the petioles and the nerves on the underside of the leaves, and also in the cymes, and with few or very few scattered, short hairs on the upperside of the leaves. *Stem* prostrate at the base, stout, succulent, swollen at the nodes, leafy part up to 7 in. long. *Leaves* very dissimilar,

the larger of a pair petioled, asymmetrical, obliquely obovate, elliptic or oblong, abruptly contracted into a narrow acumen, unequally cordate at the base with a small rounded lobe (to .2 in. long) on the broader side and gradually narrowed on the inner side, entire, membranous, light-green, 4-6 in. by 1.75-3 in., 5-8-nerved from near the base, with 2-5 nerves in the broad, and 2 in the narrow half, with oblique, on both sides distinctly raised, transverse veins; petiole stout, .5-1.5 in. long, small leaves orbicular-reniform, acute, cordate, sessile, up to .4 in. in diam. *Cymes* terminal and axillary, long-peduncled, capitate, very dense, bracteate, few- to many-flowered; peduncles rather slender, glabrescent in the upper part, bracts numerous, linear, up to .25 in. long; pedicels slender, .07-.09 in. long. *Calyx* oblong, densely shaggy from short hairs, thickened below, .07-.09 in., teeth narrow, triangular, .04 in. long. *Petals* oblong, acuminate, white or pinkish, .12 in. long, with a line of short, thick hairs on the back. *Anthers* short, oblong, obtuse, .1 in. long. *Style* filiform, .1 in. long, stigma punctiform. *Fruit* semiglobose, densely muricate, .15 in. long and wide.

PERAK; *Scortechini* 1886! Gunong Batu Pateh, in dense jungle, 3000-4000 ft. *Kunstler* 8075! 4500 ft. *Wray* 222!

27. *SONERILA CAESIA*, Stapf and King. An ascending or creeping, low herb, densely hairy on the stem, petioles and the nerves and veins on the underside of the leaves, less so in the inflorescence and with few or no hairs on the upperside of the leaves, hairs rufous, fine, straight and adpressed, particularly on the nerves, or more or less spreading on the petioles, coarse on the rhachis of the cyme and at the base of the umbels. *Stem* rather stout, prostrate below, leafy-part rarely more than .5 in. long. *Leaves* very dissimilar, the larger of a pair long-petioled, asymmetrical, obliquely elliptic, subacuminate or subobtuse, unequally cordate at the base with a large rounded lobe (.4-6 in. long) on the outer, and a minute or quite obscure lobe on the inner side, entire or subentire, sometimes ciliate along the margin, somewhat fleshy, blue-green above, pale, green beneath with reddish nerves and veins, 3-5 in. by 1.75-2.75 in., 6-7-nerved from near the base, 3-4 nerves in the outer (larger), 2 nerves in the inner (narrow) half, with subhorizontal or oblique transverse veins; petiole 1-3.5 in. long; small leaves minute, ovate-cordate, shortly petioled, or suppressed. *Cymes* terminal and from the upper leaf-axils, usually 2-3 in peduncled umbels with small bracts at the base, bracteate, few- to very-many-flowered, very dense; common peduncle slender, 1-2.5 in. long; special peduncles .25-1 in. long; pedicels slender, .08-.1 long; bracts oblong, obtuse, as long as or shorter than the pedicels, glabrous, persistent. *Calyx* obconical-campulate, .12 in. long, scabrid, crimson; teeth triangular, acute, distinct. *Petals* oblong, cuspidate-acuminate, .22 in. long, pale pink. *Anthers*

short, oblong, obtuse, .1 in. long. *Style* .25 in. long; stigma punctiform. *Fruit* semiglobose, .15 in. long and wide, tubercled, tubercles rounded.

PERAK; Gunong Batu Pateh, 3,400 ft., *Wray* 1035! UPPER PERAK; 300 ft., *Wray* 3442! 3553!

28. *SONERILA NIDULARIA*, Stapf and King. An ascending, simple, rarely furcate herb, 3–8 in. high, densely rusty-tomentose on the stem, petioles and the nerves (rarely also between the nerves) on the underside of the leaves, pubescent in the inflorescence (including the calyx), otherwise glabrous; hairs fine, flexuous, short to very short and more or less adpressed or, in the upper part of the stem, sometimes longer and more or less spreading. *Stem* prostrate at the base, stout, straight or flexuous, rooting at the base, leafy part 1–5 in. long. *Leaves* very dissimilar, the larger of a pair shortly petioled, asymmetrical, obliquely oblong to obovate-oblong, subacuminate or subobtuse, unequally cordate at the base with a larger, rounded lobe (.12–.2 in. long) on the outer and a similar, but much smaller lobe on the inner side, entire, fleshy, rather firm, dark-green above, sometimes with a row of large white spots on each side of the midrib, 3–4.5 in. by 1–2 in., 5-nerved from near the base with oblique transverse veins, the outer nerve of the inner (narrow) side marginal and often indistinct; petiole stout, .15–.6 in. long; small leaves sessile, reniform or orbicular, cordate, .2 in. or less in diam. *Cymes* terminal and axillary, sessile, minutely or obscurely bracteate, few- to many-flowered, much contracted; pedicels very short at first, ultimately up to .3 in. long, and stout. *Calyx* campanulate-oblong, .12–.15 in. long; teeth triangular, acuminate, up to .06 in. long. *Petals* obovate-elliptic, cuspidate, almost .25 in. long. *Anthers* short, oblong, obtuse, .14 in. long. *Style* .25 in. long, stigma punctiform. *Fruit* shortly turbinate, subtrigonal, muricate, .25 in. long and wide.

PERAK; *Scortechini* 650! Larut, 1000–2000 ft., *Kunstler* 2345! on hills in open jungle, *King's Coll.* 5764! Gunong Haram (?), *Scortechini* 655! Waterloo, common, *Curtis*!

29. *SONERILA BRACHYANTHA*, Stapf and King. An ascending simple or scantily branched herb, 3–8 in. high, softly hirsute or shaggy all over, hairs dense and more or less spreading on the stem, the petioles and all parts of the inflorescence (inclusive of the calyx), looser on both sides of the blades, reddish, rather long and flexuous. *Stem* rather stout, subflexuous, leafy part 1–3 in. long, branches, if any, spreading, resembling the main stem. *Leaves* very dissimilar, the larger of a pair petioled or subsessile, more or less asymmetrical, obliquely ovate-lanceolate to oblong-lanceolate, acuminate, unequally cordate at the base with a rounded lobe (.15–.25 in. long) on the outer and a minute lobe on the inner side, entire, membranous, dark brownish-green above, reddish or

deep-red or violet beneath, 2-4 in. by 1-1.5 in., 5-nerved from near the base, with 3 side-nerves in the broad and 2 side-nerves in the narrow half, uppermost side-nerves sometimes .4-.5 in. above the base, with indistinct oblique transverse veins; petioles usually short or very short, rarely up to .5 in. long; small leaves ovate-cordate, acute or reniform, .15 in. long and broad, on slender, short petioles. *Cymes* terminal and axillary, solitary or in fascicles of 2-3, subsessile, indistinctly bracteate, few- to many-flowered, very dense; peduncles very short, slender, with 2 petioled small leaflets at the base; rhachis shaggy, bracts finely filiform, ciliate, hidden among the hairs of the rhachis; pedicels very slender, about .1 in. long. *Calyx* campanulate-oblong, .12-.15 in. long, shaggy; teeth triangular-lanceolate, .07 in. long. *Petals* oblong, subacute, suberect, over .25 in. long, pinkish white or pink, with a line of hairs on the back. *Anthers* short, oblong, obtuse, .1 in. long. *Style* over .25 in. long; stigma punctiform. *Fruit* semiglobose-turbinate, muricate, .2 in. long and wide.

PERAK; *Scortechini* 1873! 1875! Goping, in dense jungle, *Kunstler* 434! 440! Larut, in dense jungle, 500-800 ft., *King's Collector* 5752! MALACCA; Kinta Gunong, 1000-1500 ft., on rocky places, *King's Collector* 7179! Gunong Inas, 5000 ft., *Wray* 4088.

30. *SONERILA MICROCARPA*, Stapf and King. An ascending herb, 3-6 in. high, rusty-tomentose on the stem, petioles and the underside of the leaves, more coarsely hairy in the inflorescence (including the calyces) from short, somewhat stiff and spreading, or soft and more adpressed (underside of the leaves) hairs, and besides with scattered, longer and stouter, flexuous hairs on the upper side of the leaves. *Stem* long, prostrate at the base, somewhat stout, straight or subflexuous, leafy part 2-4 in. long. *Leaves* very dissimilar, the larger of a pair shortly petioled, asymmetrical, obliquely obovate-lanceolate or oblanceolate, abruptly acuminate, unequally cordate at the base with a larger rounded lobe (.1-.2 in. long) on the outer, and a similar, but very minute or obscure lobe on the inner side, subentire or entire or obtusely serrulate, fleshy, rather firm, dark-green above, sometimes with numerous small white spots, 2.5-4 in. by 1-1.5 in., 4-5-nerved from near the base with oblique transverse veins, petiole .15-.4 in. long; the small leaves sessile, reniform or orbicular, cordate, .2 in. diam. *Cymes* terminal and from the upper axils, subsessile or shortly peduncled, ebracteate, few- to many-flowered, rather lax; peduncle very slender, if any, up to .5 in. long; pedicels filiform, up to .25 in. long. *Calyx* campanulate-ovoid, .12 in. by .08 in.; teeth triangular. *Petals* oblong, acute, almost .25 in. long, like the calyx pink. *Anthers* short, oblong, obtuse, .08-.1 in. long. *Style* .25 in. long; stigma punctiform. *Fruit* pale pink, subtrigynous, turbinate, minutely muricate, .08-.11 in. long, .15 in. broad.

PERAK; *Scortechini*! Upper Perak, 300 ft., Wray 3445! 3446! 3621!

31. *SONERILA COSTULATA*, Stapf and King. An ascending, unbranched herb, a few inches high, densely hirsute or tomentose on the stem, the petioles and more or less also in the inflorescence, including the calyx; adpressedly strigillose on the nerves and veins on the underside of the leaves, and with scattered, often very few, stouter hairs on the upper side of the leaves, hairs rufous, those of the stem, petioles and inflorescence flexuous, more or less spreading. *Stem* prostrate below, subflexuous, leafy part rarely more than 1 in. long. *Leaves* crowded, the larger of a pair petioled, more or less asymmetrical or the upper sometimes almost symmetrical, obliquely (if asymmetrical) obovate-oblong or oblong, subacuminate, unequally cordate at the base with a rounded lobe (.2 in. long) on the larger and a minute lobe on the narrower half, entire, ciliate along the margin, membranous, dark green, 3-6 in. by 1.3-2.5 in., 6- or rarely 7-nerved from near the base with 3 (rarely 4) nerves in the broad and 2 in the narrow half, with oblique, conspicuously prominent, transverse veins on both sides; petiole stout, .3-5 in. long; small leaves ovate-cordate to reniform, minute or up to .33 in. long, on short petioles. *Cymes* terminal and in the upper axils, solitary or 2 on a common very short peduncle, ebracteate, few- or many-flowered, contracted; rhachis very slender; peduncles very short; pedicels slender, .08-12 in. long. *Flowers* unknown. *Fruit* semiglobose-turbinate, muricate, .15-18 in. long and wide.

PERAK (?); foot of Gunong Panti, *Kunstler* 220!

Bather closely allied to *S. Beccariana*, Cogn.; but this has on the whole narrower, more acuminate leaves and much larger fruits.

32. *SONERILA MACROPHYLLA*, Stapf and King. An ascending simple herb, 3-5 in. high, softly hirsute or shaggy all over; hairs dense and more or less spreading on the stem, the petioles and all parts of the inflorescence (inclusive of the calyx), looser on both sides of the leaves, pale reddish, rather long and flexuous. *Stem* prostrate below. *Leaves* very dissimilar, the larger of a pair petioled, asymmetrical, obliquely elliptic, acuminate, unequally cordate at the base with a large, rounded lobe (.4 in. long) on the outer and a much smaller lobe on the inner side, entire or subentire, membranous, on both sides light-brown when dry, 4-6 in. by 2.2-3 in., about 7-nerved from near the base, with 4 nerves in the broad, 2 in the narrow half and with usually indistinct, fine, oblique, transverse veins, uppermost side-nerve 1-1.25 in. above the base; petiole stout, .5-1.2 in. long; small leaves ovate-cordate to reniform, up to .25 in. long, on short, slender petioles. *Cymes* terminal and in the upper axils, solitary or 2 or a common short peduncle, ebracteate, rather many-flowered, apparently very dense owing to the long interwoven

hairs; rachis slender; common peduncle very short to .7 in. long, slender, with a pair of spatulate-lanceolate, petioled leaflets at the point of branching; special peduncles very short; pedicels very slender, up to .15 in. long. *Calyx* campanulate-oblong, about .14 in. long, very shaggy; teeth triangular-lanceolate, up to .06 in. long. *Petals* oblong, acute, suberect, .3-.35 in. long; stigma punctiform. *Fruit* semiglobose-turbinate, muricate, about .2 in. long and wide.

PERAK; *Scortechini!*

VAR. *laxipilosa*, Stapf and King. All parts loosely hairy with the hairs as in the type. *Leaves* up to 6 in. by 3.5 in., rather thinner. Common and special peduncles short or up to 3 in. long (together).

PERAK; Ipoh, Kinta, *Curtis* 3154! Pulau Butong, *Curtis!*

33. *SONERILA PARADOXA*, Naud. in *Ann. Sc. Nat. Ser. 3, XV, 321.* A low, creeping herb, softly hirsute or shaggy all over; hairs dense and more or less spreading on the stem, petioles and all parts of the inflorescence (including the calyx), looser on both sides of the blades, reddish, rather long and flexuous. *Stem* creeping, slender to rather stout, rooting, the leaf-bearing, terminal part rising rarely more than .5 in. above the ground. *Leaves* crowded, very dissimilar, the larger of a pair petioled, asymmetrical, obliquely oblong or elliptic, shortly acuminate, unequally cordate at the base, with a large rounded lobe (.25-.5 in. long) on the outer and a similar but much smaller lobe on the inner side, entire or subentire, membranous, soft, light-green, 3-6 in. by 1.2-2.5 in., 6-8 nerved from near the base (3-5 nerves in the broader half), with oblique curved transverse veins; petiole .4-2 in. long or the uppermost very short; small leaves rotundate-ovate or reniform, cordate, .08-.4 in. in diam., on very slender petioles (.08-.6 in. long). *Cymes* terminal and from the upper axils, solitary with a pair of small petioled leaflets at the middle of the peduncle, or in umbels of 2-4, ebracteate or inconspicuously bracteate, few- to many-flowered, dense; common peduncle slender, usually 1-2 in. long; special peduncles much shorter; rachis very shaggy; bracts linear to filiform, ciliate, short, usually hidden among the hairs of the rachis or suppressed; pedicels .08-.1 in. long, very slender. *Calyx* campanulate-oblong, about .15 in. long, shaggy; teeth short, triangular. *Petals* oblong, acute, suberect, over .25 in. long, white. *Anthers* oblong, obtuse, .1 in. long. *Style* over .3 in. long; stigma punctiform. *Fruit* semiglobose-turbinate, .12-.15 in. long, .18 in. wide, muricate-tuberculate. *S. moluccana*, Jack. *Misc. I, 8; Wall. Cat. 4089; Bean. Pl. Jav. Rar. 215, (p.p.); Blume, Mus. I, 10 (p.p.); Miq. Fl. Ind. Bat. I, 562 (p.p.); C. B. Clarke in Hook. f. Fl. Brit. Ind. II, 537 (p.p.); Triana in Trans. Linn. Soc. XXVIII, 77; Cogn. in DC. Monogr. VII, 508 (p.p.); Stapf in Ann. Bot. VI, 311, 312 (p.p.); and Roxb. Flor. Ind. I, 178?*

PENANG; Wallich Cat. 4089! Griffith 2298! Maingay 780 (Kew Distrib.) in shady, damp places, 1500–3000 ft., Stoliczka, Hullet 196! King's Coll. 1284! Palloh Bahang, Curtis 411! SINGAPORE (P); Lobb 325!

Roxburgh says of his *S. moluccana*, "Habitat in insulis Moluccanis." His description is extremely short and insufficient, and there does not seem to have been a specimen in his herbarium nor was it figured by him. It is very improbable that the plant he described was identical with the Penang plant, if he received it really from the Moluccas, as the distribution of most species of the section *Hexadon* is very local, and no specimens, referable to *S. paradoxa*, have been discovered, so far, east of the Malay Peninsula. On the other hand, it is possible that Roxburgh meant *S. malaccana* instead of "*S. moluccana*" and *insulis malaccanis* for "*ins. moluccanis*," as the editors of his Flora Indica put it. There is at least nothing in his description which would contradict the assumption that his brief diagnosis was drawn up from the Penang plant. In view of this uncertainty we have preferred to follow Naudin and to consider Roxburgh's *S. moluccana* as a "species dubia" and adopt Naudin's name for the Penang plant.

34. *SONERILA BEGONIAEFOLIA*, Blume in Flora (1831), 490. An ascending, usually unbranched herb, 2–6 in. high, moderately hairy with the exception of the often glabrous upper side of the leaves; hairs of the stem, petioles and the inflorescence rufous, flexuous, more or less spreading, of the leaves confined to the nerves and veins of the underside, often scanty, very short. *Stem* rather slender, rooting below. *Leaves* very dissimilar, the larger of each pair petioled, more or less asymmetrical, obliquely elliptic, subacuminate, unequally cordate at the base with a rounded lobe (2–3 in. long) on the outer and a much smaller on the inner side, entire or more or less obtusely serrulate, ciliolate, membranous, dark-green above, pale brown (when dry) beneath, 3–4 in. by 1.7–2.3 in., 6- sub-7-nerved from near the base (with 3–4 nerves in the broader half), with usually very conspicuous subhorizontal transverse veins; petiole .4–1.2 in. long; small leaves ovate to rotundate, acute, cordate, very small, distinctly petioled. *Cymes* terminal and axillary, peduncled, dense, at length up to .8 in. long, deciduously bracteate; peduncle slender, up to 1.5 in. long; bracts linear-oblong, ciliolate, up to .1 in. long, deciduous; pedicels .07–.1 in. long. *Calyx* campanulate-oblong, teeth broad, triangular. *Petals* ovate, acute. *Anthers* short, oblong, obtuse. *Fruit* shortly turbinate, .18–.22 in. long and wide, muricate-tuberculate, tubercles rather coarse, acute, mostly passing into short fine bristles. Korth. in Verh. Nat. Gesch. Bot. 248, t. 54; Naudin in Ann. Sc. Nat. Ser. 3, XV, 322; Triana in Trans. Linn. Soc. XXVIII, (1873), 77. *S. moluccana*, Benn. Pl. Jav., Har. 215; Miq. Fl. Ind. Bat. I, 562; C. B. Clarke in Fl. Brit. Ind. I, 562; Cogn. in DC. Monogr. VII, 508; Stapf in Ann. Bot. VI, 312 (all references under *S. moluccana*, p.p.).

SINGAPORE; Bukit Tunat, *Ridley* 2005! Chanchukang, *Ridley* 422!  
 Bukit Mandu, *Ridley* 2005/a! JOHORE; Gunong Panti, *Ridley* 4199!  
 DISTRIB. Sumatra, Java, South Borneo.

There being no flowers with the specimens enumerated, they have been described from Korthals, l.c. The Sumatra specimens have leaves which are more or less hairy or bristly on the upper side and represent Blume's VAR. *pilosiuscula* of *S. begoniaefolia* (Blume, Mus. I. 11) or *S. moluccana* VAR. *pilosiuscula* Stapf, l.c. A specimen from South Borneo, collected by Motley, is almost glabrous on the upperside of the leaves.

35. *SONERILA GLABRIFLORA*, Stapf and King. A creeping or ascending herb, a few inches high, with a long creeping rhizome, hairy on the stem, peduncles, petioles and the nerves on the underside of the leaves, otherwise glabrous; hairs reddish, straight, adpressed. *Stem* rather stout, slightly swollen at the nodes, frequently rooting, leafy part 1-4 in. long. *Leaves* very dissimilar, the larger of each pair petioled, asymmetric, obliquely elliptic, obtuse or subacute, unequally cordate at the base with a large, rounded lobe on the outer and small or obscure one on the inner side, entire or obscurely and remotely toothed, fleshy, soft, dark glossy-green above, pale with purple nerves beneath, 3-6 in. by 2-3.5 in., with 3-5 lateral nerves in the outer and 2-3 in the inner half near the base and with rather lax subhorizontal transverse veins; petiole rather stout, 1-2.5 in. long, the small leaves sessile, reniform-cordate, .2-2.5 in. in diam. *Cymes* terminal and axillary, usually 2- or 3-nate on a common peduncle, ebracteate, many-flowered, rather dense, glabrous, when ripe up to 1.3 in. long, common peduncle 1-2 in., special peduncles .5-1.2 in. long, slender; pedicels very slender, .1-1.2 in. long. *Calyx* campanulate-ovoid, .12-1.5 in. by .06 in.; teeth very broad and short. *Petals* elliptic, acute, almost .25 in. long, white or tinged with pink. *Anthers* linear-oblong, obtuse, .12 in. long. *Style* .15 in. long; stigma punctiform. *Fruit* subtrigonous, hemispherical, quite smooth, .15-1.6 in. long and wide; valves in the depressed centre of the capsule 6, delicately membranous, fragile.

PERAK; Larut, in wet jungles, up to 100 ft., *Kunstler* 1955! 2128!

36. *SONERILA ELATOSTEMOIDES*, Stapf and King. An erect, ascending or creeping, unbranched or scantily branched herb, up to 6 in. high, softly tomentose in all parts, hairs rusty coloured, short, spreading and very dense on the stem and petioles, somewhat laxer in the inflorescence inclusive of the calyx, pale and longer on the leaves. *Stem* slender, subflexuous. *Leaves* very dissimilar, the larger of each pair petioled, asymmetrical, obliquely oblong-elliptic or obovate, acuminate, unequally cordate at the base with the outer lobe broad, rounded, up to .2 in. long and the inner similar but much smaller, entire, membranous, green



above, whitish green below, 2·2-2·8 in. by 1-1·2 in., 6-7-nerved from near the base (with 3-4 lateral nerves in the broad and 2 in the narrow half) with oblique transverse veins, nerves and veins not very distinct; petiole ·18-·4 in. long; small leaves reniform-cordate, subsessile, ·15 in. in diam. *Cymes* terminal and axillary, long peduncled, few-flowered, not very dense, ebracteate; peduncle slender, ·6-1 in. long; pedicels slender, ·02 in. long. *Calyx* oblong-campanulate, ·08 in. long, teeth short. *Petals* oblong, acute, ·18 in. long, with a line of hairs on the back. *Anthers* short, oblong, obtuse, ·09 in. long. *Style* ·2 in. long; stigma punctiform. *Fruit* semiglobose, muricate, ·12 in. long and wide.

PERAK; Gunong Bubu, *Wray* 3825!

37. *SONERILA BICOLOR*, Stapf and King. An ascending or suberect, nearly always unbranched herb, 3-9 in. high, softly hairy all over, hairs pale, straight, fine, spreading except on the upper side of the leaves, very dense in the upper part of the stem, on the petioles and in the inflorescence inclusive of the calyx. *Stem* rather slender, subflexuous, slightly swollen at the nodes. *Leaves* very dissimilar, the larger of each pair more or less asymmetrical, shortly petioled, obliquely oblong to lanceolate-oblong, distinctly acuminate, unequally cordate at the base with a rounded lobe (to ·4 in. long) on the outer, and a minute or obscure lobe on the inner side, ciliate along the margin, membranous, soft, dark green or magenta-red above with a light green band along the midrib, purple beneath, 3-6 in. by 1-1·5 in., finely 5-nerved from near the base (uppermost nerve from ·4-·6 in. above the base, with faint oblique transverse veins; petiole ·2-·6 in. long; small leaves ovate to rotundate, cordate, shortly petioled, very small to ·4 in. long. *Cymes* terminal and axillary, peduncled, loosely few- to 10-flowered, ebracteate; peduncle slender, ·4-1·2 in. long; pedicels ·1-·2 in. long, slender, also when mature. *Calyx* oblong-subcampanulate, ·12 in. long; teeth triangular, short. *Petals* elliptic-oblong, acute, ·35 in. long, pink. *Anthers* linear-oblong, subobtuse, ·12 in. long. *Style* ·35 in. long; stigma punctiform. *Fruit* semiglobose, ·12-15 in. long and wide, muricate, opening with 6 thinly membranous teeth in the depressed centre or with 3, 2-toothed valves.

PERAK; Ulu Salama, 500 ft., *Wray* 4159! Larut, in dense jungle, 500-800 ft., *King's Coll.* 5794! Tapa, *Baldwin*!

38. *SONERILA CALYCULA*, Stapf and King. An ascending or creeping herb, about 6 in. long, rusty tomentose on the stem, petioles and peduncles, and pubescent on the nerves on the underside of the leaves, otherwise glabrous; hairs short, curled or flexuous, loosely adpressed. *Stem* rather stout, straight, rooting in the lower part, leafy part about 4 in.

long. *Leaves* very dissimilar, the larger of each pair petioled, symmetrical, or almost so, lanceolate, gradually tapering towards both ends, entire, somewhat fleshy, pale-brown on both sides when dry, 3.5–5.5 in. by .8–1.25 in., 5-nerved from the base (the outer nerves faint, submarginal) with faint oblique transverse veins; petiole .35–.4 in. long; small leaves reniform, cordate, very minute, .05 in. in diam., or suppressed. *Oymes* terminal and from the upper axils, peduncled, few-flowered; peduncle filiform, .4–.5 in. long; pedicels fine, not spongy when mature, .1–.12 in. long. *Flower* unknown. *Fruit* semiglobose, smooth, .08–.1 in. by .12 in., crowned by the ultimately deciduous calyx-margin the teeth of which are very broadly triangular and cuspidate.

PAHANG; Taban River, *Ridley* 2237!

#### 9. PHYLLAGATHIS, Blume.

Herbaceous small shrubs with very short stems. *Leaves* opposite (or the terminal leaf solitary), large, petioled, orbicular, or sub-orbicular, 7–9-nerved. *Flowers* in a peduncled dense head, purple. *Calyx-tube* campanulate, glabrous or with long bristles near the top, teeth 4 (rarely 3), acute, long-setose. *Petals* 4 (rarely 3), ovate, acute, glabrous. *Stamens* 8 (rarely 6), equal; anthers elongate, scarcely produced at the base, connective without appendage. *Ovary* adnate to the bottom of the calyx-tube, 4- (rarely 3-) celled, glabrous at the apex; style filiform; ovules very numerous, placentas large axile. *Capsule* broadly funnel-shaped, opening by 4 valves at the top. *Seeds* ellipsoid, somewhat obovoid, with glandular, hardly raised dots; raphe slightly excurrent along one side of the seed its whole length.—**DISTRIB.** Species 5; all Malayan.

- |  |                             |
|--|-----------------------------|
| Leaves oblanceolate ... ..   | 1. <i>P. tuberculata</i> .  |
| Leaves more or less orbicular; peduncles of inflorescence many inches long and as long as or longer than the long petioles:— |                             |
| Flowers in narrow, shortly branched panicles ...   | 2. <i>P. Griffithii</i> .   |
| Flowers in terminal solitary ebracteate umbels:—   |                             |
| Peduncles glabrous ... ..  | 3. <i>P. Scortechinii</i> . |
| Peduncles hispid ... ..  | 4. <i>P. hispida</i> .      |
| Flowers in bracteate umbels with peduncles 1 or 2 inches long ... ..   | 5. <i>P. rotundifolia</i> . |

1. **PHYLLAGATHIS TUBERCLATA**, King, n. sp. *Stem* short, woody, erect, covered with small warts. *Leaves* two or three, membranous, oblanceolate, shortly acuminate, very gradually narrowed to the short hispid petiole, 7- to 9-nerved; upper surface glabrous except for a few

scattered stout bristles; lower surface coarsely strigose on the nerves, otherwise glabrous, the reticulations fine; length 10 to 16 in., breadth 3 to 6 in., petiole 0 to 1.5 in. *Peduncles* much shorter than the leaves, solitary or several from one axil, sparsely glandular-hairy, bearing at their apices a solitary, lax, involucrate, compound umbel; involucre oblong, obtuse, glabrous, .5 in. in length or shorter, those of the umbellules smaller; pedicels shorter than the calyx-tube. *Flowers* nearly .75 in. long. *Ocalyx-tube* rather widely cylindric, bearing (especially towards its base) numerous flat, shortly stalked, fleshy discoid glands; the teeth 4, short, shallow, wide, each crowned by a stalked gland. *Petals* longer than the calyx, oblong, much acuminate (forming a narrow cone in bud). *Stamens* 8; the filaments about one-fourth as long as the linear acuminate anthers. *Ovary* short, broad, truncate, deeply grooved and almost winged; style long, flattened, smooth. *Capsule* .3 in. in diam.

PERAK; *Scortechini* 1872. *King's Collector* 7233.

At once recognisable by the curiously glandular calyx.

2. *PHYLLAGATHIS GRIFFITHII*, King. A shrub with a very short stem and usually only a single pair of unequal leaves. *Leaves* coriaceous, sub-rotund, 7-nerved, apex obtuse, the base cordate, edges quite entire; both surfaces glabrous, the lower lepidote and slightly puberulous on the nerves; length 5 to 8 in., breadth 3.5 to 6.5 in., petiole 4 to 8 in. *Panicle* axillary, nearly as long as the leaves, bearing in its upper half a few very short few-flowered branches, the whole lepidote especially towards the apex. *Flowers* corymbose, on scaberulous pedicels, as long as the narrowly campanulate glandular-hairy calyx-tube: mouth of calyx truncate, slightly expanded, and minutely 4-toothed. *Petals* 4, quadrate. *Stamens* much exerted: *anthers* not so long as the glabrous filaments, narrow acuminate, much sagittate at the base, inappendiculate. *Allomorpha Griffithii*, Hook. MSS. Fl. Br. Ind. II, 527. Triana in Trans. Linn. Soc. XXVIII, 74, t. VI, fig. 66c; Cogn. in DC. Mon. Phan. VII, 467.

MALACCA: *Griffith* (K.D.) 2264/1. *Maingay* (K.D.) 775; *Hullett*. PERAK; *Scortechini* 170; *King's Collector* 694. SELANGORE; *Curtis* 2338! *Ridley* 7817. PENANG; *Stolickza*.

I have removed this from *Allomorpha* to *Phyllagathis* of which it has the flowers and habit.

3. *PHYLLAGATHIS SCORTECHINII*, King, n. sp. *Stem* woody below, shortly creeping above and subterete. *Leaves* on very long petioles, coriaceous, reniform-rotund, cordate, the apex minutely apiculate, stoutly 9-nerved; the transverse veins bold, glabrous on the upper surface, glandular-puberulous on the lower; length 5 to 10 in.; breadth

5 to 9 in.; petiole 4 to 9 in., stout. *Peduncles* solitary, longer and more slender than the petioles, bearing at the apex a single dense, ebracteate umbel. *Flowers* nearly 5 in. long to the apices of the stamens, their pedicels .25 in. long. *Calyx-tube* narrowly campanulate, not ribbed, glabrous, very minutely lepidote; the teeth 4, broad, rounded, shallow. *Petals* rotund-ovate, blunt, short. *Stamens* 8; the filaments about half as long as the linear acute anthers. *Ovary* grooved, short, broad; style as long as the anthers, cylindric, glabrous. *Capsule* about .2 in. in diam., truncate, the valves broad, truncate.

PERAK; *Scortechini* 269; *King's Collector* 4287. SELANGORE; *Ridley* 7317.

This species is closely allied to *P. Griffithii* but differs notably in its solitary terminal umbels.

4. *PHYLLAGATHIS HISPIDA*, King, n. sp. *Stem* very short, woody, hispid. *Leaves* 2 or 3, sub-coriaceous, on long petioles, broadly ovate, cordate at the base, the apex abruptly and shortly acuminate, the edges with minute, sharp, sometimes unequal teeth, 7- to 11-nerved, the transverse nerves strong: upper surface glabrous, the lower uniformly covered with minute, scurfy pubescence, the main nerves with a few long, spreading, stout bristles; petiole densely shaggy near the base, more sparsely hispid upwards: length 5 to 10 in., breadth 3 to 7 in.; petioles varying from 4 to 12 in. *Peduncle* axillary, shorter than the leaves and more slender than the petioles, sparsely hispid; the umbel few-flowered, ebracteate. *Flowers* .75 in. long; their pedicels slender, hispid, longer than the calyx. *Calyx-tube* narrowly cylindric or cylindric-campanulate, nearly glabrous, or sparsely hispid; the mouth with 4 broad, shallow, blunt teeth. *Petals* broadly ovate, acute. *Stamens* 8; *anthers* not much longer than the filaments, broadly lobed and cordate at the base, and the connective with a short, narrowly cylindric basal protuberance behind. *Ovary* very short; *style* filiform. *Capsule* .2 in. across.

PERAK; *Scortechini*! *Wray* 1021, 1602, 3519. PAHANG; *Ridley* 2236.

5. *PHYLLAGATHIS ROTUNDIFOLIA*, Blume in *Flora*, 1831, 507. *Stem* creeping, obtusely 4-angled. *Leaves* unequal in the pairs, rotund or rotund-ovate and shortly apiculate; both surfaces, but especially the lower, minutely lepidote; main nerves 7 to 9, curved, radiating from the base, the transverse nerves bold, curved; petioles unequal, from .85 to 3.5 in. long, their interior surfaces covered with coarse black bristles; length 2 to 8 in.; breadth 1.5 to 6 in. *Inflorescence* 4- to 30-flowered; the involucre orbicular-ovate acuminate. *Calyx-tube* ribbed, minutely lepidote; the teeth triangular, broad at the base but with

elongate narrow apices bearing 2 or 3 bristles; filaments from one-fourth to one-half of the length of the linear stamens. Ovary 4-angled, the apex with a truncate cartilaginous rim. Korth. in Verh. Nat. Gesch. Bot. 252, t. 57; Naud. in Ann. Sc. Nat. Ser. 3, XXV, 332; Bot. Mag. t. 5282; Miq. Fl. Ind. Bat. I, 559; Triana Melast., tab. VI, fig. 73; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 541; Cogn. in DC. Mon. Phan. VII, 518. *Melastoma rotundifolia*, Jack in Trans. Linn. Soc. XIV, 11; DC. Prodr. III, 149.

MALACCA; Griffith, *Maingay*. SELANGORE; Ridley 7327. PERAK; Scortechini, King's Collector, Wray. DISTRIB. Burma, Sumatra, Java; common.

Rather variable as to size of leaves and as to the number of bristles on their petioles. The teeth of the calyx also vary as to the length of the acuminate apex and as to the number of bristles.

#### 10. MARUMIA, Blume.

Twining shrubs; branches cylindric, thickened at the nodes. Leaves opposite, short-petioled, coriaceous, cordate at the base, 3-nerved from the base besides two submarginal nerves, entire, stellate-tomentose beneath. Oymes axillary; flowers 3-5, large, pedicelled, purple or white. Calyx-tube narrowly campanulate, tomentose (and often bristly or stellate-hairy); lobes 4, deep, persistent. Petals 4, obovate. Stamens 8, unequal; anthers elongate, opening by a single pore; connective of the longer anthers carrying in front two long bristles and behind often one or two spurs or several twisted bristles. Ovary at the base (or half its height) adnate to the calyx, 4-celled, densely hairy at the apex; style filiform; ovules numerous, placentas axile. Berry ellipsoid, crowned by the calyx-limb. Seeds numerous, oblong-ellipsoid, with glandular scarcely raised dots, raphe slightly excurrent along the whole length of one side.—DISTRIB. Species 10, Malaya, Borneo and the Philippines.

Calyx-tube without bristles	...	..	...	1. <i>M. nemorosa</i> .
Calyx-tube very bristly :—				
Teeth of limb of calyx half as long as the tube, oblong, acute: upper surface of leaves not reticulate	...	...	...	2. <i>M. rhodocarpa</i> .
Teeth of limb of calyx one-fourth as long as the tube or less, broadly triangular, blunt; upper surface of leaves much reticulate	...	...	...	3. <i>M. reticulata</i> .

1. MARUMIA NEMOROSA, Blume in Flora XIV, (1831), 505. A straggling climber; all parts except the upper surfaces of the leaves, the petals, stamens and ovaries covered with dense rufous or pale stellate

tomentum, without bristles; the branches thickened and annulate at the nodes. *Leaves* sub-coriaceous, elliptic or oblong-lanceolate, slightly cordate at the base, the apex shortly acuminate or acute, 5-nerved (the lateral pair of nerves faint); upper surface glabrous; length 8 to 6 in.; breadth 1.35 to 2.75 in.; petiole .2 to .4 in. long. *Flowers* about 1.75 in. long (including the stamens), solitary or in pedunculate cymes of three from the axils of the leaves. *Calyx-tube* more or less narrowly campanulate, somewhat constricted below the limb; limb with 4 deep, triangular teeth. *Petals* broadly ovate, blunt, longer than the calyx-tube, rose-coloured. *Stamens* 8, unequal; the anthers of all linear, curved; the longer with two narrow, curved filaments at the base in front, and several smaller behind; the four smaller with two smaller, equal filaments at the base in front only. *Fruit* succulent, oblong-ovoid, constricted below the permanent calyx-teeth, sometimes sub-tuberculate and always stellate-tomentose, about 1 in. long. Blume Mus. Bot. I, 33; Naud. in Ann. Sc. Nat. Ser. 3, XV, 279; Miq. Fl. Ind. Bat. I, pt. I, 533; Triana in Trans. Linn. Soc. XXVIII, 82; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 542; Cogn. in DC. Mon. Phan. VII, 549. *M. affinis*, Korth. in Verh. Nat. Gesch. Bot. 241, t. 60; Miq. l.c. 533. *Melastoma nemorosum*, Jack in Trans. Linn. Soc. XIV, 8; DC. Prodr. III, 149; Wall. Cat. 4043.

In all the provinces except the Nicobar and Andaman Islands.  
DISTRIB. Sumatra, Borneo.

2. *MARUMIA RHODOCARPA*, Cogn. in DC. Mon. Phan. VII, 550. A powerful climber; young branches, petioles, lower surfaces of leaves and calyx densely clothed with minute, pale, stellate tomentum intermixed with numerous stout, spreading, brown bristles, the nodes somewhat swollen and with transverse lines. *Leaves* sub-coriaceous, oblong, narrowed to the rounded, minutely cordate base, the apex shortly acuminate, 5-nerved (the lateral pair slender); upper surface glabrous; length 3.5 to 5 in.; breadth 1 to 2 in.; petiole .15 to .2 in. *Flowers* (including the stamens) nearly 1.5 in. long, in axillary, pedunculate cymes of three. *Calyx-tube* longer than the glabrous pedicel, narrowly campanulate, constricted below the limb; limb with 4 oblong, acute teeth half as long as the tube and like the latter bearing many long, curved bristles. *Petals* white, obovate. *Stamens* 8, unequal, all linear and acuminate: the four larger with two long, filiform appendages in front and several smaller behind: the four smaller with about 4 to 6 appendages. *Fruit* shortly ovoid, crowned by the large calyx-teeth, bristly, .4 in. in diam. *Melastoma rhodocarpum*, Wall. Cat., 4045. *Marumia echinata*, Naud. Ann. Sc. Nat. Ser. 3, XV, 280; Miq. Fl. Ind. Bat. I, pt. I, 534. *M. seylanica*, Triana

(not of Blume) in Linn. Trans. XXVIII, 82, tab. VII, fig. 88b; C. B. Clarke in Fl. Br. Ind. II, 542.

SINGAPORE; *Wallich*; *Anderson* 68, 69; *Hullett* 125; *Bidley* 258; *King's Collector* 278. MALACCA; *Maingay* (K.D.) 785; *Cuming*; *Griffith* (K.D.) 2270.

VAR. *sub-glabrata*, Cogn. l.c. 550. Leaves glabrous beneath except the nerves. *M. zeylanica*, C. B. Clarke (not of Blume), VAR. *sub-glabrata*, Hook. fil. Fl. Br. Ind. II, 542.

SINGAPORE; *Anderson* 64.

3. *MARUMIA RETICULATA*, Blume Mns. Bot. I, 34. Scandent; young branches, petioles, under surfaces of leaves and calyx densely clothed with rusty stellate, more or less deciduous hairs, the young branches, petioles and especially the calyx with stout spreading bristles intermixed; the nodes swollen and annulate. *Leaves* subcoriaceous, ovate-lanceolate, 5-nerved (the lateral pair slender), minutely cordate at the base, the apex shortly acuminate; upper surface deeply reticulate, glabrous; length 2 to 3.5 in., breadth .8 to 1.5 in., petiole .1 to .2 in. *Flowers* 1.25 in. long (including the anthers), axillary, either solitary on pedicels as long as themselves or in pedunculate cymes of three; the middle flower being nearly sessile, the lateral pair on short pedicels. *Calyx-tube* densely hispid externally, the teeth 4, short, broadly triangular and blunt, tomentose on the inner surface. *Petals* ovate, sub-acute, glabrous. *Stamens* 8, the anthers somewhat unequal in length but all linear, curved and with two long appendages at the base in front. *Fruit* ovoid, (unripe) .5 in. in diam., crowned by the calyx-teeth. Miq. Fl. Ind. Bat. I, pt. I, p. 535; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 542; Cogn. in DC. Mon. Phan. VII, 551. *M. stellulata*, Korth. (not of Blume) Ver. Nat. Gesch. Bot. 243. *M. oligantha*, Naud. in Ann. Sc. Nat. Ser. 3, XV, 281; Miq. l.c. 534.

MALACCA; *Griffith* (K.D.) 2269; *Maingay* 784. **DISTRIB.** Sumatra, Java.

#### 11. *DISSOCHÆTA*, Blume.

Shrubs, usually twiners. *Leaves* opposite, petioled or nearly sessile, elliptic or oblong-lanceolate, rounded at the base, 5-nerved from the base (the two submarginal nerves slender), entire. *Flowers* in terminal, sometimes leafy panicles, purple or white, bracts large or small. *Calyx-tube* campanulate-cylindric or funnel-shaped, densely stellate-tomentose, pubescent or glabrous; limb obscurely 4-lobed or entirely truncate, more rarely distinctly 4-toothed, persistent. *Petals* 4. *Stamens* 8, unequal, 4 shorter sometimes wanting, connective of the 4 longer with 2 long bristles in front at the base. *Ovary* adnate to the

calyx, 4-celled, apex glabrous or densely hairy; style filiform; ovules very many, placentas axile. *Berry* ovoid or elliptic, crowned by the calyx-limb. *Seeds* ellipsoid, flattened on the side of the raphe.—**DISTRIB.** Species 25; throughout Malaya to the Philippines.

**Stamens 8 (four of them sometimes imperfect):—**

Young branches, under surfaces of leaves and panicles covered with persistent stellate-tomentum:—

The stellate-tomentum not mixed with bristles; the nodes with transverse interpetiolar lines:—

- |                              |                          |
|------------------------------|--------------------------|
| Flowers 1·75 in. long ... .. | 1. <i>D. annulata.</i>   |
| Flowers ·75 in. long ... ..  | 2. <i>D. punctulata.</i> |

The stellate-tomentum mixed with spreading persistent bristles; flowers ·75 in. long ...

3. *D. hirsuta.*

Young branches, under surfaces of leaves and panicles covered at first with stellate-tomentum which ultimately more or less disappears:—

Bracts of panicle obovate, persistent ... .. 4. *D. bracteata.*

Bracts of panicle linear, deciduous ... .. 5. *D. pallida.*

Young branches, under surfaces of leaves and panicles covered with minute simple scales not stellate ...

6. *D. gracilis.*

**Stamens 4:—**

Panicles ebracteate, or bracts, if any, caducons:—

Flowers ·3 in. long; fruit ·15 to ·2 in. in diam.; mouth of calyx-tube 4-toothed; petals broadly oblong, blunt; stamens blunt, not appendiculate at the apex ... ..

7. *D. celebica.*

Flowers ·5 in. long; fruit ·2 to ·25 in. in diam.; mouth of calyx-tube truncate not toothed; petals ovate, acute; stamens narrowed to the appendiculate apex ... ..

8. *D. intermedia.*

Panicles with persistent, oblong bracts:—

Young branches at first rusty stellate-hairy, finally glabrous; branches of panicle divaricating, lax ... ..

9. *D. anomala.*

Young branches with persistent, pale, adpressed, stellate hairs; branches of panicle short, condensed ... ..

10. *D. Scortechinii.*

1. **DISSOCHÆTA ANNULATA**, Hook. fil. ex Triana in Trans. Linn. Soc. XXVIII, 83. A strong climber; young branches, petioles, under surfaces of leaves and inflorescence covered with dense, rusty, deciduous stellate tomentum, the nodes thickened and slightly annulate. *Leaves* coriaceous, ovate-oblong, cordate at the base, the apices shortly and rather abruptly acuminate, upper surface at first sparsely stellate-hairy, ultimately glabrous, the nerves and reticulations bold; length 2·5 to 3·5 in.; breadth 1 to 1·8 in.; petiole ·2 to ·5 in. *Panicle* solitary terminal, much longer than the leaves, lax, the branches divaricating,



cymose, 1- to 3-flowered; bracts small, caducons. *Flowers* 1.5 in. long (including the stamens), pedicels much shorter than themselves. *Calyx-tube* narrowly campanulate or funnel-shaped, the mouth widened and with 4 blunt, triangular teeth, densely stellate-hairy outside. *Petals* obovate-oblong, blunt, reflexed. *Stamens* 8; curved, elongate-linear, acuminate, with two bristle-like appendages at the base in front, lacinate behind. *Fruit* ellipsoid, succulent, crowned by the enlarged teeth of the calyx-tube. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 543; Cogn. in DC. Mon. Phan. VII, 557. *Melastoma bracteatum*, Wall. Cat. 4044 (in part).

PENANG; *Wallich* 4044; *Griffith* (K.D.) 2268; *Maingay* (K.D.) 788; *Curtis* 740. MALACCA; *Wallich*. SINGAPORE; *Hullet* 213; *Ridley* 5187. JOHORE; *King's Collector* 224. PERAK; *Scortechini* 235. DISTRIB. Borneo.

2. *DISSOCHETA PUNCTULATA*, Hook. fil. ex Triana in Linn. Trans. XXVIII, 83. Young branches thickened but not annulate, clothed like the petioles, under surfaces of the leaves and the inflorescence with minute, rusty scales. *Leaves* coriaceous, oblong-ovate, the base rounded and not cordate, the apex acute or very shortly acuminate; 5-nerved, the marginal nerves very slender; upper surface glabrous; length 3 to 4.5 in.; breadth .75 to 1.75 in.; petiole .25 to .4 in. *Panicles* solitary, terminal, several times longer than the leaves, the branches and branchlets short and the latter cymosely few-flowered, bracts small, linear, deciduous. *Flowers* .75 in. long (including the stamens), on pedicels shorter than themselves. *Calyx-tube* infundibuliform, the mouth with a broad, everted, wavy, obscurely toothed edge, deciduously scaly. *Petals* 4, ovate, sub-acute, glabrous. *Anthers* 8, equal, curved, cylindrical, attenuated to the 1-pored apex, the base with two long, geniculate, upward-curving, narrow, flattish appendages. *Fruit* succulent, urceolate, slightly warty, sub-glabrous, crowned by the slightly enlarged mouth of the calyx, .4 in. long. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 543; Cogn. in DC. Mon. Phan. VII, 555.

MALACCA; *Griffith* (K.D.) 2291! *Maingay* 789. SINGAPORE; *Ridley* 3918, 4803. SELANGORE; *Ridley* 2015. JOHORE; *Ridley* 3246, 2106. PENANG; *Walker*, etc.

3. *DISSOCHETA HIRSUTA*, Hook. fil. ex Triana Trans. Linn. Soc. XXVIII, 83. A strong creeper with slender branches only slightly thickened at the nodes; all parts except the upper surfaces of the leaves and the petals densely clothed with deciduous, stellate hairs mixed with long, stiff, spreading, curved hairs. *Leaves* membranous, lanceolate or ovate-lanceolate, 5-nerved (the lateral pair slender), the base rounded and slightly cordate, the apex shortly acuminate; upper surface

glabrous, length 3 to 4·5 in.; breadth 1 to 1·75 in.; petiole ·15 to ·3 in. *Panicle* solitary, terminal, thickened at the nodes, broadly pyramidal, much branched. *Flowers* ·75 in. long. *Calyx-tube* longer than the pedicel, cylindric-tubular, the mouth not everted but with four linear elongate teeth. *Petals* 4, broadly lanceolate, blunt. *Stamens* 8, equal, all perfect, elongate and narrow, the apices much prolonged into a rather thin appendage, the base with two delicate, filiform appendages. *Fruit* ovoid-globose, crowned by the persistent calyx-limb, densely setose-lepidote, ·4 in. in diam. Cogn. in DC. Mon. Phan. VII, 556.

JOHORE; at the base of Gunong Panti; *King's Collector* 197; *Ridley* 4185. DISTRIB. Borneo.

4. DISSOCHÆTA BRACTEATA, Blume in *Flora*, 1831, 495. Young branches with a transverse ridge at the nodes, petioles and panicles more or less densely clothed with sub-deciduous, rusty, stellate hairs, and the under surfaces of the leaves sparsely so. *Leaves* membranous, 5-nerved (the marginal pair faint), ovate-lanceolate, the base rounded and often sub-cordate, the apex acute or shortly acuminate; upper surface glabrous, the lower sparsely stellate-hairy; length 3 to 4·5 in.; breadth 1·25 in.; petiole ·2 to ·3 in. *Panicles* much bracteate, both axillary and terminal, the former shorter, the latter longer, than the leaves; the branches few, divaricate. *Flowers* 1·2 in. long (including the stamens), in cymes at the ends of the branchlets, each subtended by, and while in bud enveloped in, a membranous, obovate, blunt, stellate-pubescent, more or less permanent bract about ·5 in. long. *Calyx-tube* twice as long as the pedicels, cylindric-campanulate, the mouth slightly widened and minutely 4-toothed. *Petals* broadly elliptic, blunt, glabrous. *Stamens* 8, much curved, long, linear, the base with two long flattened, linear, upward-pointing appendages. *Fruit* ellipsoid, crowned by the rim of the calyx-tube, ·6 in. long. Miq. Fl. Ind. Bat. I, pt. I, 529; Triana in *Trans. Linn. Soc.* XXVIII, 84; C. B. Clarke in *Hook. fil. Fl. Br. Ind.* II, 543; Cogn. in DC. Mon. Phan. VII, 598. *D. bracteosa*, Naud. in *Ann. Sc. Nat. Ser. 3*, XV, 76; Miq. Fl. Ind. Bat. I, pt. I, 527. *Melastoma bracteatum*, Jack in *Trans. Linn. Soc.* XIV, 9; *Wall. Cat.* 4044, partly.

PENANG; *Wallich*, *Cat.* 4044; *Curtis* 2298. MALACCA; *Maingay* 791. DISTRIB. Borneo, *Haviland*.

5. DISSOCHÆTA PALLIDA, Blume in *Flora*, 1831, 500. A shrubby creeper, 20 to 50 feet long; young branches thickened and with interpetiolar ridges at the nodes, sparsely covered with minute stellate-hairy scales like the petioles, under surfaces of the leaves and the panicles. *Leaves* sub-coriaceous, 5-nerved (the lateral pair faint), elliptic-ovate to ovate, the base rounded and sub-cordate, the apex shortly acuminate

or acute; upper surface glabrous; length 2·5 to 5 in.; breadth 1·2 to 2·2 in.; petiole ·8 to ·5 in. *Panicles* both axillary and terminal, the former shorter than the leaves or slightly exceeding them, the latter longer, all rather lax, the branchlets divaricating, cymose, and with a few short, linear, deciduous bractlets. *Flowers* nearly 1 in. long (including the stamens). *Calyx-tube* oblong-campanulate or funnel-shaped, densely lepidote-stellate; the mouth expanded and obscurely 4-toothed. *Petals* obovate-oblong, blunt, glabrous. *Stamens* 8, usually equal (four sometimes shorter or obsolete); basal processes long, linear, sub-erect. *Fruit* cylindrical-campanulate, sub-glabrous, crowned by the slightly enlarged limb of the calyx, ·25 in. long. Blume, Mus. Bot. I, 36 (excl. syn. Korth.); Naudin in Ann. Sc. Nat. Ser. 3, XV, 69, tab. 4 fig.; Miq. Fl. Ind. Bat. I, pt. I, 528; Triana in Trans. Linn. Soc. XXVIII, 83, tab. VII, fig. 89b; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 544; Cogn. in DC. Mon. Phan. VII, 557. *Melastoma pallida*, Jack in Trans. Linn. Soc. XIV, 12; DC. Prodr. III, 150; Wall. Cat. 4049. *Dissochæta ovalifolia* and *D. superba*, Naud. l.c. 76 and 77. *D. astrotricha*, Miq. l.c. Suppl. 318.

In all the provinces except the Nicobar and Andaman Islands; common.

The four stamens which are usually shorter than the other are sometimes obsolete.

6. DISSOCHÆTA GRACILIS, Blume in Flora, 1831, 498. A straggling or scandent shrub; young branches slender, bluntly 4-angled, the nodes swollen and transversely ridged, minutely scaly like the petioles, leaves and panicles. *Leaves* 5-nerved (the lateral pair slender), broadly lanceolate or oblong-lanceolate, rounded at the base and shortly acuminate at the apex; length 3 to 4·5 in.; breadth 1·5 to 1·8 in.; petiole ·2 to ·4 in. *Panicles* axillary and terminal, the former shorter than, and the latter longer than the leaves, slender, spreading, lax, many-flowered; bracts few, narrowly oblong, caducous. *Flowers* ·35 in. long, on filiform pedicels longer than themselves. *Calyx-tube* narrowly campanulate, minutely stellate-pubescent, the mouth glabrous, sub-truncate, everted, and obscurely 4-toothed. *Petals* 4, broadly ovate or sub-orbicular, blunt. *Stamens* 8; four large, perfect, rather short, with a broad truncate 2-pored apex; the four imperfect small, narrow; all with two erect, filiform flat basal appendages. *Fruit* sub-globular, crowned by the narrow limb, almost glabrous, ·1 to ·15 in. in diam. Korthals Verb. Nat. Gesch. Bot. 237; Naud. in Ann. Sc. Nat. Ser. 3, XV, 75; Miq. Fl. Ind. Bat. I, pt. I, 526; Triana in Trans. Linn. Soc. XXVIII, 83, tab. VII, fig. 89c; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 544; Cogn. in DC. Mon. Phan. VII, 559. *Melastoma gracile*, Jack

54 G. King—*Materials for a Flora of the Malayan Peninsula*. [No. 1, in Trans. Linn. Soc. XIV, 14; DC. Prodr. III, 149. *M. fallax*, Wall. Cat. 4080. ? *M. glauca*, Griff. Ic. Pl. As. 637. *M. vacillans*, var. *pallens*, Blume, Bijdr. 1074.

In all the provinces except the Nicobar and Andaman Islands. **DISTRIB.** JAVA, BORNEO.

7. **DISSOCHÆTA CELEBICA**, Blume, Mus. Bot. I, 36. A slender creeper; young branches, petioles and under surfaces of the leaves, also the panicles, densely clothed with rusty, scurfy, stellate tomentum. *Leaves* 3-nerved, membranous, lanceolate or oblong-lanceolate, the base rounded, the apex shortly acuminate; upper surface glabrous except the stellate-pubescent midrib; length 2·5 to 5 in.; breadth 1 to 2 in.; petiole ·2 to ·25 in. *Panicles* lateral and terminal, the former slightly longer and the lateral several times longer than the leaves, ebracteate, the branches divaricating, the ultimate branches cymose, 3-flowered. *Flowers* ·3 in. long (including the stamens). *Calyx-tube* oblong-campanulate, slightly widened and 4-toothed at the mouth, somewhat longer than the pedicel. *Petals* 4, broadly oblong, blunt. *Stamens* 4; anthers equal, short, blunt and with no apical appendage, opening by 2 apical pores. *Fruit* sub-globular, crowned by the narrow limb of the calyx, faintly 8-ribbed, sparsely pubescent or sub-glabrous, ·15 to ·2 in. in diam. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 544; Cogn. in DC. Mon. Phan. VII, 561; Miq. Fl. Ind. Bat. I, pt. I, 530; Triana in Trans. Linn. Soc. XXVIII, 83. *D. microcarpa*, Naud. in Ann. Sc. Nat. Ser. 3, XV, 72; Miq. l.c. 523. *D. bancana*, Miq. l.c. 529. *Melastoma fallax*, Wall. Cat. 4050; ? Jack in Trans. Linn. Soc. XIV, 13. *M. rubiginosum*, Wall. Cat. 4052, partly.

In all the provinces except the Nicobar and Andaman Islands; common. **DISTRIB.** BANGKA, CELEBES, BORNEO.

**VAR.** *contracta*, King. *Panicle* solitary, terminal, short, condensed, not longer than the leaves.

**PERAK**; King's Collector 2911.

8. **DISSOCHÆTA INTERMEDIA**, Blume in Flora, 1831, 493. A somewhat slender creeper, resembling *D. celebica* in its other parts, but with larger flowers (·5 in. long), pointed in bud; larger fruit (·2 to ·25 in. in diam.); calyx-tube with a truncate, toothless mouth; ovate, acute petals, and longer stamens narrowed to and appendiculate at the apex. Blume, Mus. Bot. I, 35, tab. V; Naud. in Ann. Sc. Nat. Ser. 3, XV, 72; Miq. Fl. Ind. Bat. I, pt. I, 524; Triana in Trans. Linn. Soc. XXVIII, 83, tab. VII, fig. 89 f.; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 544; Cogn. in DC. Mon. Phan. VII, 562. *Melastoma rubiginosum*, Wall. Cat. 4052 (in part).

**MALACCA**; Griffith (K.D.) 2287; Helfer (K.D.) 2286. **PENANG** and **SINGAPORE**; Wallich. **PERAK**; Scortechini. **DISTRIB.** JAVA, BORNEO.

9. *DISSOCHÆTA ANOMALA*, King, n. sp. A creeper 15 to 20 feet long; young branches slender, slightly thickened at the nodes, at first sparsely rusty stellate-hairy, afterwards glabrous and sub-glaucous. *Leaves* ovate-oblong, the base broadly rounded, the apex shortly, abruptly and bluntly acuminate, 5-nerved (the two lateral nerves faint); upper surface glabrous; the lower sparsely stellate-hairy on the midrib and nerves, otherwise glabrous; length 3.5 to 6.5 in.; breadth 1.75 to 2.75 in.; petiole sparsely hispid, .2 in. long. *Panicles* axillary and terminal, the former half as long and the latter twice as long as the leaves, stellate-pubescent especially at the thickened nodes; the branches divaricate, trichotomous, lax, bracteate at the divisions; the bracts .3 in. long, oblong, blunt, involute, stellate-tomentose, their edges ciliate. *Flowers* .3 in. long, in cymes of three. *Calyx-tube* shorter than the pedicel, narrowly campanulate, densely stellate-tomentose; the mouth without teeth, truncate, not everted. *Petals* glabrous, ovate, acuminate, forming a pointed bud. *Stamens* 4, equal and all perfect, subsessile, broad, blunt, the lateral basal appendages filamentous. *Fruit* broadly campanulate, crowned by the narrow calyx-limb, glabrous, .15 in. in diam.

PERAK; *King's Collector* 2258, 10468.

This plant forms a collecting link between the genera *Anplectrum* and *Dissochæta* as they are defined in this work. It agrees in externals with *Anplectrum pallens*, and has the 4 stamens of that genus, but their anthers have the elongate basal processes so well developed in *Dissochæta* and not at all represented in *Anplectrum*.

10. *DISSOCHÆTA SCORTECHINII*, King, n. sp. Scandent; young branches slender, the nodes swollen and transversely ridged, thinly clothed with minute, pale, stellate hairs. *Leaves* ovate-lanceolate, slightly cordate at the broad base, the apex with a short, blunt point; 5-nerved (the lateral pair small); upper surface glabrous; lower rusty in colour and bearing sparse, white, stellate hairs longer than those on the stem; length 2.5 to 3.75 in.; breadth 1.5 to 2 in.; petiole densely rusty stellate-tomentose, .1 in. long. *Panicle* solitary, narrow, terminal, shorter than the leaves, densely rusty stellate-tomentose, the branches short and few-flowered, bearing many oblong, blunt or spatulate, pale, 3-nerved almost glabrous bracts longer than the flower-bud, the lower ones much larger. *Flowers* .3 in. long, their pedicels short. *Calyx-tube* narrowly campanulate, at first densely but afterwards sparsely stellate-tomentose; the mouth truncate, without teeth, waved but not everted, glabrous. *Petals* 4, glabrous, orbicular-ovate, acuminate, forming a pointed bud. *Stamens* 4, all equal and perfect, short, broadly ovate, the base with two long, erect, filiform appendages, the broad apex with a small, pale,

subacute appendage. *Fruit* unknown. *D. intermedia*, Scort. MSS. (not of Blume), in Herb. prop.

PERAK; *Scortechini* 23, 34. PENANG; *Curtis* 1301.

## 12. ANPLECTRUM, A. Gray.

Twining shrubs. *Leaves* subcoriaceous, or rarely coriaceous, opposite, short-petioled, entire, oblong, narrowed upwards, 3-5-nerved from the base. *Flowers* white, in terminal panicles sometimes leafy at the base. *Calyx-tube* funnel-shaped or ovoid, limb obscurely 4-lobed or truncate. *Petals* 4. *Stamens* 4 perfect, rarely 8, anthers attenuated upwards, opening by one pore, connective at base shortly appendaged or subnude, never with two long bristles in front, rarely with a long appendage and two small erect bristles; imperfect stamens 4, 2, or 0. *Ovary* 4-celled, free at the apex, with 4 vertical ridges; style simple; ovules many, placentas axile. *Berry* ovoid or globose, crowned with the calyx-limb. *Seeds* very many, small, falcate, obovoid; raphe long, lateral. **DISTRIB.** Species about 18, in Malaya and the Philippines.

Stamens 4 perfect:—

Nodes of the young branches and of the lower part of the panicle with conspicuous, stellately lepidote, bristly annuli ... .. 1. *A. lepidoto-setosum*.

Nodes of the young branches and of the panicle with a small smooth annulus or faint transverse ridge:—

Calyx-tube funnel-shaped; stamens 4, all perfect; young branches stellate-hairy ... 2. *A. glaucum*.

Calyx-tube ovoid to globular-ovoid; stamens 8, the anthers of 4 of them narrow and imperfect; young branches glabrous or nearly so ... .. 3. *A. pallens*.

Nodes not annulate; stamens 8, the anthers of 4 of them narrow and imperfect; young branches and panicles densely stellate-scaly ... .. 4. *A. divaricatum*.

Stamens 8 perfect ... .. 5. *A. anomalum*.

1. ANPLECTRUM LEPIDOTO-SETOSUM, King, n. sp. Young branches slender, conspicuously annulate at the nodes, sparsely clothed with coarse, spreading hairs with thickened points, the very youngest also with deciduous, stellate hairs. *Leaves* oblong-lanceolate, 5-nerved; the base rounded and minutely cordate, the apex shortly caudate-acuminate; both surfaces glabrous except for a few coarse hairs near the petiole; the lower shining and pale when dry; length 4.5 to 6 in.; breadth 1.1 to 1.8 in.; petiole very short, attached to the cup-shaped, densely rufous stellate-tomentose node and like it with scattered

bristle-hairs. *Panicle* terminal, solitary, shorter than the leaves, everywhere densely rusty-tomentose with long bristles intermixed, annulate at the bases of the short, spreading, few-flowered branches. *Calyx-tube* cylindrical; the mouth undulate-truncate, obscurely toothed, its outer surface stellate-lepidote with a few long bristles near the mouth. *Petals* 4, ovate, glabrous. *Stamens* 8 (4 large and 4 small); the large broad, and with a short, grooved ridge on the back near the base, blunt; the 4 small linear, very acuminate. *Capsule* ovoid-globular, truncate, nearly glabrous, .15 in. in diam.

PERAK; *Scortechini* 2106.

2. ANPLECTRUM GLAUCUM, Triana in Trans. Linn. Soc. XXVIII, 84 (excluding much of the synonymy). Scandent, to 20 or 30 feet; young branches 4-grooved, stellate-hairy like the petioles and main nerves of the leaves and the inflorescence, the nodes inconspicuously annulate or transversely ridged. *Leaves* oblong-lanceolate, rounded or slightly narrowed to the often slightly cordate base, the apex shortly acuminate or acute, boldly 3-nerved; both surfaces glabrous except for some scattered, stellate hairs; length 3 to 5 in.; breadth 1 to 2 in.; petiole .5 to .25 in. *Panicle* large, terminal, solitary, several times larger than the leaves, pyramidal, its branches divaricate, many-flowered. *Flowers* drooping, .4 or .5 in. long (including the stamens). *Calyx-tube* funnel-shaped, sub-glabrous; the mouth truncate, not toothed, everted with age. *Petals* ovate-lanceolate with truncate bases, the apex acuminate. *Stamens* 4; *anthers* much curved, all perfect, their bases not lobed but with a corrugated membranous process in front. *Ovary* prominently 4-winged. *Fruit* truncate, sub-globular, glabrous, .2 in. long (when dry). C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 545; Cogn. in DC. Mon. Phan. VII, 566. *A. cyanocarpum*, Kurz in Journ., As. Soc., 1877, pt. 2, p. 78 (not of Triana). *Melastoma glauca*, Jack in Trans. Linn. Soc. XIV, 15; DC. Prodr., 151. *M. cernuum*, Wall. Cat. 4055 (not of Roxb.). *Osbeckia tetrandra*, Roxb. Fl. Ind. II, 224. *Dissochæta glauca*, Blume in Flora, 1831, p. 501. *D. spoliata*, Naud. in Ann. Sc. Nat. Ser. 3, XV, 69, t. 4, fig. 1.

In all the provinces, common. **DISTRIB.** Sumatra, Java, Borneo.

3. ANPLECTRUM PALLENS, Blume, Mus. Bot. I, 38. Scandent, to 30 or 40 feet; young branches terete, glabrous or minutely puberulous, especially near the slightly thickened and transversely ridged nodes, round. *Leaves* oblong, the base rounded, the apex abruptly, bluntly and shortly sub-caudate-acuminate, 5-nerved (the marginal pair slender), the edges (when dry) slightly recurved; upper surface glabrous, the lower minutely and scantily stellate-puberulous; length 1.5 to 4.5 in., breadth .5 to 1.5 in.; petiole .1 to .2 in. *Panicles* axillary (about as  
J. II. 8

long as the leaves) and terminal (much longer than the leaves), slender, spreading, lax, rather few-flowered, with a small, blunt, oblong, deciduous bract under each branch, finely rufous stellate-pubescent. *Flowers* about  $\cdot 4$  in. long (including the stamens). *Calyx-tube* ovoid to globular-ovoid, densely rufous-puberulous when young, glabrous when old, the mouth slightly expanded and with very small teeth. *Petals* ovate, acute, glabrous. *Anthers*; the four large much curved and sub-acute; the rudimentary linear, acuminate. *Capsule* globose-obovoid, glabrous,  $\cdot 15$  in. in diam. Naud. in Ann. Sc. Nat. Ser. 3, XV, 303; Triana in Trans. Linn. Soc. XXVIII, 303; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 545; Cogn. in DC. Mon. Phan. VII, 564. *Melastoma petiolare*, Wall. Cat. 4053.

In all the provinces except the Andaman and Nicobar Islands; not uncommon. DISTRIB. Sumatra, Borneo.

4. ANPLECTRUM DIVARICATUM, Triana in Trans. Linn. Soc. XXVIII, 84 (in part), tab. VII, fig. 90b. Scandent, to 20 or 30 feet; young branches obscurely quadrangular, and like the petioles, nerves of the leaves on both surfaces, and the inflorescence, densely covered with tawny, stellate scales, not annulate at the nodes. *Leaves* lanceolate, acute or sub-acute, the base minutely cordate, 5-nerved, the marginal pair slender; both surfaces, but especially the lower, with glandular-punctate scales between the nerves and veins; length 2 to 3 in.; breadth  $\cdot 6$  to  $1\cdot 1$  in.; petiole  $\cdot 15$  to  $\cdot 25$  in. *Panicle* solitary, terminal, pyramidal, several times as long as the leaves, the branchlets divaricate, each with two ovate-lanceolate, ciliate, furfuraceous, deciduous bracts at its base and three flowers in a cyme at the apex. *Flowers*  $\cdot 4$  in. long, on short pedicels. *Petals* oblong, acute. *Calyx-tube* narrowly obovoid, campanulate, truncate, densely furfuraceous stellate-tomentose. *Anthers* 8; the 4 large thick and much curved, obtuse; the smaller narrow. *Capsule* globose-obovoid, with a narrow, everted rim, length  $\cdot 15$  to  $\cdot 2$  in. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 546; Cogn. in DC. Mon. Phan. VII, 567. *Melastoma divaricatum*, Willd. Spec. Pl. II, 596; DC. Prodr. III, 150. *M. polyanthum*, Benth. in Wall. Cat. 4051. *Dissochaeta divaricata* and *D. pepericarpa*, Naud. Ann. Sc. Nat. Ser. 3, XV, 70 and 71. *D. anceps*, Naud. l.c. 70. *D. palembanica*, Miq. Fl. Ind. Bat. Suppl. 317.

MALACCA; Griffith (K.D.) 2288/1: Maingay (K.D.) 794: Harvey. PENANG; Wallich 4051. PERAK; King's Collector 369. DISTRIB. Java, Borneo, Sumatra.

5. ANPLECTRUM ANOMALUM, King and Stapf, n. sp. A woody creeper, 20 to 100 feet long; young branches as thick as a wheat-straw, terete, covered with stellate, rusty scurf. *Leaves* coriaceous, obovate or



oblong, blunt, much narrowed to the base, 3-nerved, glabrous on the upper, rusty stellate-hairy on the lower surface like the petioles and inflorescences; length 1 to 1.5 in.; breadth .6 to .9 in.; petiole .2 in. *Panicles* terminal, sometimes leafy, 3 to 6 in. long, lax, the branches in pairs, divaricate, many-flowered, minutely bracteolate at the divisions. *Flowers* .35 in. long, the pedicels somewhat longer. *Petals* oblong, obtuse, waxy, reflexed, pale greenish-white. *Stamens* 8, equal; anthers inflexed in aestivation, lanceolate-subulate, the base of the lobes produced into an elongated halbert-shaped process with two erect subulate processes at its broad upper end. *Fruit* (not quite ripe) ovoid-globose, greenish-yellow, .2 in. in diam.

PERAK; *King's Collector* 5779, 10357.

This plant differs from *Anplectrum*, as the genus has hitherto been limited, in having 8 anthers, each of which has a very much produced halbert-shaped basal process, from which two erect hair-like appendages origiuate at the upper or broad end. The plant agrees better with *Anplectrum* than with any other *Melastomaceous* genus, but it might possibly be better treated as the basis of a new one.

### 13. MEDINILLA, Gaud.

Branching shrubs, erect or scandent. *Leaves* opposite or whorled; rarely alternate, entire, often fleshy, mostly glabrous, usually longitudinally 3-9-nerved. *Flowers* in terminal panicles or lateral cymes, white or rose, with or without bracts, 4- or 5-, rarely 6-merous. *Calyx-tube* ovoid or cylindric, limb truncate or obscurely toothed. *Stamens* twice as many as the petals, equal or nearly equal (rarely unequal); anthers opening at the top by one pore; connective not (or very shortly) produced at the base but having two tubercles in front and a spur behind. *Ovary* inferior, 4-6-celled, usually glabrous at the apex; style filiform; ovules very many, placentas axile. *Berry* crowned by the limb of the calyx. *Seeds* very many, ovoid or subfalcate, raphe often thickened and excurrent.—**DISTRIB.** Species about 100; mainly in Malaya, East Bengal and Ceylon; a few in the Fiji Archipelago and in the East African islands.

**Flowers 4-merous:—**

Leaves alternate ... .. 1. *M. scandens.*

Leaves in whorls (large) ... .. 2. *M. speciosa.*

**Leaves opposite:—**

Flowers in terminal panicles, anthers dissimilar ... 3. *M. heteranthera.*

**Flowers in lateral panicles, anthers similar:—**

Anther-cells with tubercles at their bases in front,  
and a short spur from the connective behind:—

Flowers 1 in. long ... .. 4. *M. venusta.*

Flowers under .5 in. long:—			
Leaves petiolate	...	...	5. <i>M. Hasseltii</i> .
Leaves sessile	...	...	6. <i>M. Scortechinii</i> .
Anther-cells with tubercles at the base in front, but no spur from the connective behind			
		...	7. <i>M. Maingayi</i> .
Flowers 5-merous:—			
Leaves in whorls:—			
Leaves elliptic or obovate, blunt, 1 to 2.75 in. long, fruit .15 in. in diam.	...	...	8. <i>M. Clarkei</i> .
Leaves oblanceolate or narrowly obovate, acuminate, 3 to 5 in. long; fruit .4 in. in diam.	...	...	9. <i>M. crassinervia</i> .
Leaves elliptic-rotund, blunt, 2.5 to 5.5 in. long; fruit .35 in. in diam.	...	...	10. <i>M. perakensis</i> .

1. *MEDINILLA SCANDENS*, King, n. sp. A climber, 15 to 30 feet long, rooting and adhering to trees; the stems rough, as thick as a swan's quill. *Leaves* alternate, glabrous, long-petioled, subcoriaceous, elliptic or ovate-oblong, shortly acuminate, the base cuneate; nerves 5 to 7, mostly from the midrib above its base; length 4.5 to 9 in.; breadth 2.5 to 6 in.; petioles 1.5 to 7 in. *Flowers* .4 in. long, in dense fascicles in the axils of fallen leaves, on rusty-puberulous, minutely bracteolate pedicels. *Calyx-tube* narrowly campanulate; the limb very slightly expanded, truncate, very obscurely toothed. *Petals* 4, ovate-oblong, acute. *Stamens* 8; *anthers* narrowly elliptic, with a long apical 1-pored beak; and at the base a short, broad, blunt process from the connective behind, the lobes of the anthers slightly produced in front and minutely tuberculate.

PERAK; *Scortechinii* 86 and 150; *King's Collector* 1814.

This resembles *M. alternifolia*, Blume, but has a much shorter spur from the connective at the base of the anthers. It has also larger leaves and more numerous flowers in the fascicles.

2. *MEDINILLA SPECIOSA*, Blume in *Flora*, 1831, p. 515. A glabrous shrub or small tree, not epiphytal; young branches as thick as the little finger, 3- or 4-angled; the bark shining, pale when dry, bearing at the nodes numerous stout, subulate bristles .5 in. long. *Leaves* large, subcoriaceous, in whorls of 3 (rarely of 4) or in pairs, sessile, or very shortly petiolate, oblanceolate or obovate-oblong, sometimes elliptic, acute, the base cuneate, nerves 7 to 9 mostly from the midrib above its base, all except the lowest pair bold, the veins slender; length 6 to 12 in.; breadth 2.75 to 5 in. *Panicles* lateral and terminal, 4 to 8 or even 14 in. long, on peduncles equally long, many-flowered; the branches with a whorl of small reflexed bracts at their bases; whorled, spreading, minutely bracteolate at the divisions. *Calyx-tube* cupular, slightly constricted below the narrow, minutely 4-toothed limb. *Petals* 4, ovate-

acute. *Fruit* ovoid, .3 in. in diam. Bot. Mag. t. 4321; Morren in Ann. Soc. Hort. Gand. V, 261; Naud. in Ann. Sc. Nat. Ser. 3, XV, 291; Miq. Fl. Ind. Bat. I, pt. I, p. 540; Triana in Linn. Trans. XXVIII, 87; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 549. *Melastoma eximium*, Blume Bijdr. (not of Jack). *Melastoma speciosum*, Reinw. ex Blume, in Flora, 1831, 516.

MALACCA; *Maingay* (Kew Distrib.) 798. PENANG; *Hullett* 203; *Curtis* 874; *King's Collector* 1595. PERAK; *Wray* 3218; *King's Collector* 2652. DISTRIB. Moluccas, Java, Sumatra.

3. *MEDINILLA HETERANTHERA*, King, n. sp. Epiphytal and terrestrial; branches slender, smooth, reddish when fresh, drying dark purplish-brown. *Leaves* of the pairs somewhat unequal, ovate-lanceolate to lanceolate, acuminate, the base slightly narrowed, glabrous, 3-nerved; length 2.5 to 5.25 in.; breadth 1 to 1.8 in.; petioles .3 to .8 in. *Panicles* terminal on the branches, half as long as the leaves, corymbosely cymose, 5- or 6-flowered, minutely bracteolate. *Flowers* .75 in. long, their pedicels much shorter. *Calyx-tube* cylindric, the mouth wide and with 4 broad, shallow teeth. *Petals* 4, ovate-lanceolate, shortly acuminate. *Stamens* 8; *anthers* unequal, the larger four twice as long as the shorter four, all curved, much acuminate and with two tubercles at the base in front, the shorter 4 with a short spur on the connective behind, the larger with no spur. *Fruit* globular-ovoid, crowned by the wide calyx-limb, .35 in. in diam.

PERAK; *Scortechini* 341; *King's Collector*, 3291, 3644, 6304, 6904; *Wray* 397; at elevations of from 3000 to 4500 feet.

This resembles *M. Horsfieldii*, Miq.,—a species from Java and Borneo—which however has 5-merous flowers, obovate petals and leaves of thinner texture. According to Scortechini the petals are waxy white tinged with red and the stamens are yellow.

VAR. *latifolia*. *Leaves* broadly elliptic, shortly acuminate, the base cuneate, 2.5 to 3.75 in. long and 1.5 to 2 in. broad.

PERAK; *King's Collector* 8917; *Wray* 268.

4. *MEDINILLA VENUSTA*, King, n. sp. Epiphytal, 2 to 4 feet long, glabrous; branches stout, with large, scattered tubercles, glabrous. *Leaves* large, opposite, thinly coriaceous, sessile, elliptic, shortly acuminate, narrowed to the base, boldly 3-nerved above the base with often a faint, small, basal, marginal pair; length 6 to 9 in.; breadth 2.75 to 4 in. *Oymes* much shorter than the leaves, laxly umbellate, axillary or from the axils of fallen leaves, about 6-flowered; the pedicels slender, bibracteolate at the base. *Flowers* nearly 1 in. long. *Calyx-tube* campanulate, .35 in. long, with a narrow, obscurely 4-toothed limb.

*Petals* 4, broadly ovate, acute. *Stamens* 8; *anthers* equal, linear-lanceolate, much acuminate, curved, the tubercles at the front of the base as long as the posterior basal spur from the connective. *Fruit* unknown.

PERAK; *King's Collector* 2390.

5. *MEDINILLA HASSELTII*, Blume in *Flora*, 1831, p. 513. Epiphytal on trees, 3 or 4 feet high; branches slender, terete, pale, more or less prominently warted (the warts black). *Leaves* opposite, coriaceous, oblong-lanceolate, acuminate, narrowed to the rounded base, 3-nerved, with sometimes a faint, additional lateral pair; length 4.5 to 5.5 in.; breadth 1.25 to 1.75 in.; petioles .15 to .35 in. *Cymes* axillary or from the axils of fallen leaves, less than half as long as the leaves, (more than half as long in *VAR. Griffithii*), broader than long; the branches divaricate, 8-12-flowered, minutely bracteolate. *Flowers* .35 in. long. *Calyx-tube* campanulate-cylindric, somewhat constricted below the minutely 4-toothed mouth. *Petals* 4, obovate-oblong. *Stamens* 8, equal; the anthers linear-oblong, somewhat curved, the base with two short, black, conical protuberances in front and a similar one behind. *Fruit* globular, truncate, .2 to .25 in. in diam. *Miq. Fl. Ind. I*, pt. I, 542; *C. B. Clarke in Hook. fil. Fl. Br. Ind. II*, 547; *Cogn. in DC. Mon. Phan. VII*, 586. *Melastoma laurifolium* in *Wall. Cat.* 4084 (not of Blume). *Medinilla crassifolia*, *Triana in Trans. Linn. Soc. XXVIII*, 86 (in part).

MALACCA; *Griffith* (*Kew Distrib.*) 2282; *Maingay* (*Kew Distrib.*) 797, *Wallich* 4084. PERAK; very common. SINGAPORE; *Anderson*. SUNGAI UJONG; *Ridley* 2205, SELANGORE; *Curtis* 2334; *Ridley* 286. PANGKORE; *Curtis* 1642.

DISTRIB. Java, Sumatra.

*VAR. Griffithii*, *C. B. Clarke in Hook. fil. Fl. Br. Ind. II*, 547. *Cymes* much branched, more than half as long as the leaves, many-flowered.

MALACCA; *Griffith* (*Kew Distrib.*) 2282.

6. *MEDINILLA SCORTECHINII*, King, n. sp. Epiphytal, 3 or 4 feet high; stems as thick as a goose-quill, the bark brown (when dry), sparsely verrucellate. *Leaves* opposite, coriaceous, glabrous, sessile, stem-clasping, oblong-ovate to oblong, shortly acuminate, the base sub-cordate, 3-nerved, with occasionally a faint pair at the margin; length 4.5 to 6.5 in.; breadth 1.5 to 2.75 in. *Panicles* cymose, axillary, rather shorter than the leaves, very lax, spreading; the branches slender, minutely bracteolate at the divarications; the branchlets compressed, sometimes 2-winged. *Flowers* nearly .4 in. long, on pedicels as long as themselves. *Calyx-tube* campanulate, the mouth not much

expanded, obscurely 4-toothed. *Petals* 4, oblong, acute, reflexed. *Stamens* 8; anthers curved, linear-lanceolate, with a short 1-pored apical process; the base with a short, sharp, downward-pointing spur from the connective; the bases of the anther-cells each with a linear, curved, small tubercle as long as the spur, and like it dark in colour when dry. *Fruit* ovoid-globular, .2 in. in diam.

PERAK; *Scortechini* 307, 478, 622; *Curtis* 1297; *Wray* 391, 1739; *King's Collector* 4188.

The nearest ally of this is *M. javanensis*, Bl.

7. *MEDINILLA MAINGAYI*, C. B. Clarke in Hook. fl. Fl. Br. Ind. II, 549. A small epiphyte with slender, terete, pale, smooth branches. *Leaves* opposite, thinly coriaceous, obovate, with rounded apices and cuneate bases, obscurely 3-nerved, the lower surface rather paler than the upper when dry; length .65 to 1.25 in.; breadth .5 to .75 in.; petiole .05 to .2 in. *Cymes* much shorter than the leaves, with short, divaricate, broadly bracteolate branches, few-flowered. *Flowers* .25 in. long, their pedicels shorter. *Calyx-tube* narrowly campanulate, with a slightly expanded, minutely 4-toothed limb. *Petals* 4, lanceolate, sparsely strigose outside. *Stamens* 8; anthers lanceolate, without protuberences at the base in front, but with a short spur behind. *Fruit* unknown. Cogn. in. DC. Mon. Phan. VII, 586.

MALACCA; *Maingay* (Kew Distrib.) 806, 807. PERAK; *Wray* 3781. SINGAPORE; *Ridley* 1652, 2018. PAHANG; *Ridley* 2663.

8. *MEDINILLA CLARKEI*, King, n. sp. A small epiphyte; young branches with dark, rough, tubercled bark. *Leaves* in whorls of three or four, broadly elliptic to obovate, blunt or subacute, the base cuneate; the upper surface rugulose and green when dry, the lower pale-brown; length 1 to 2.75 in., breadth .75 to 1.8 in.; petiole .4 to .8 in., puberulous. *Cymes* about as long as the leaves or slightly longer, from the axils of fallen leaves, on slender pedicels from .5 to .75 in. long, the branches whorled, spreading, minutely bracteolate at the divisions; pedicels slender. *Flowers* 20 to 30, .3 in. in length. *Calyx-tube* cupular, the mouth truncate and usually obscurely toothed, sometimes distinctly 5-toothed. *Petals* 5, broadly ovate to rotund, blunt. *Stamens* 10; anthers linear-lanceolate; the base with two small tubercles in front, and a small spur behind. *Fruit* globular-truncate, .15 in. in diam. *M. rosea*, C. B. Clarke in Hook. fl. Fl. Br. Ind. II, 547 (*not of Gaudichaud*).

MALACCA; *Griffith* (Kew Distrib.) 2282; *Maingay* (Kew Distrib.) 796; *Stoliczka* in Herb. Calc. PERAK; *Scortechini* 243; *Wray* 206, 412, 3831, 4084; *King's Collector* 7333; at elevations of from 3000 to 5000 feet.

*M. rosea*, Gaud., to which this plant has been referred in the Flora of British India, is a tetramerous species from the Marianne Islands. It has, moreover, larger flowers than this and larger, more acute leaves. This plant varies in the size of its leaves: specimens collected at the highest elevations having the largest leaves. The structure of the flowers is, however, uniform.

9. *MEDINILLA CRASSINERVIA*, Blume in Flora, 1831, 510. Branches with pale bark, the older terete, the youngest striate when dry. *Leaves* in whorls of 3, coriaceous, broadly oblanceolate, or narrowly obovate, shortly and abruptly acuminate, much narrowed to the base, 3-nerved from a little above the base, occasionally with two short lateral faint nerves from the very base; length 3 to 5 in.; breadth 1·5 to 2 in.; petiole ·35 to ·75 in. *Flowers* in short fascicles on the stem below the leaves, in few-flowered pedunculate cymes, mixed with a few solitary, on pedicels ·5 in. long. *Calyx-tube* ovoid-campanulate, the mouth truncate and almost entire. *Stamens* 10, subequal; the basal anterior processes broad and about as long as the filiform posterior spur. *Fruit* globose with a cylindric truncate mouth, ¼ in. across. Blume Rumphia I, 15; Miq. Fl. Ind. Bat. I, pt. I, 545; Cogn. in DC. Mon. Phan. VII, 574. *M. macrocarpa*, Clarke (not of Blume) in Hook. fil. Fl. Br. Ind. II, 547.

SINGAPORE; *Ridley* 1637. PENANG; *Curtis* 2225. PERAK; *Wray* 1821. MALACCA; *Maingay* (Kew Distrib.) 799. DISTRIB. BORNEO.

True *M. macrocarpa*, Bl., is represented in the Kew Herbarium by a single specimen collected by Blume in the Moluccas. The flowers on it have, as described by the author of the species, an irregularly toothed calyx-limb. The plant now described differs in having an almost entire truncate limb, and I follow Cogniaux in referring it to *M. crassinervia*, Bl. In the Flora of British India it is, however, referred to *M. macrocarpa*, Bl.

10. *MEDINILLA PERAKENSIS*, King, n. sp. Epiphytal; branches terete, glabrous, tubercled. *Leaves* in whorls of 3 or 4, coriaceous, elliptic-rotund, blunt, the base rounded and narrowly cordate, glabrous; 5-nerved, the lateral pair of nerves faint; length 2·5 to 5·5 in.; breadth 1·75 to 3·75 in.; petioles ·6 to 1·2 in. *Panicles* cymose, on rather long peduncles from the axils of fallen leaves, shorter than the leaves, lax, 12- to 20-flowered; branches spreading, whorled, 2-3-chotomous. *Flowers* ·5 in. long, their pedicels ·35 in. *Calyx-tube* cupular; the limb but little expanded, cut into 5 shallow, broad teeth. *Petals* 5, oblong. *Anthers* 10, curved, with 2 yellow tubercles at the base in front and a short spur behind from the connective. *Fruit* ·35 in. in diam.; the seeds oblong, obtuse, with an excurrent tail, the testa pitted.

PERAK; *Scortechini* 410; *Wray*.

Collected only by the late Father Scortechini and Mr. Wray. According to the field-note of the former, the petals and anthers are white and the fruit blueish-

carnation. The nearest ally of this is *M. montana*, Cogn.—a New Guinea species—which has however, longer flowers, a wider calyx-tube, more slender branches which are moreover smooth, and narrower leaves narrowed at the base.

#### 14. POGONANTHERA, Blume.

*Shrubs*; branches round, minutely scaly. *Leaves* opposite, petioled, oblong or ovate, entire, glabrous, 3-nerved. *Flowers* small, pulverulent, in small, terminal panicles having opposite, cymose branches. *Calyx-tube* narrowly campanulate, subquadrangular; limb 4-toothed. *Petals* 4, oblong-lanceolate. *Stamens* 8, equal; anthers oblong, acute, opening by a terminal pore, not produced at the base; connective at the base bearded behind with a tuft of hairs, not spurred. *Ovary* half-inferior, 4-celled, with a tuft of hairs at the apex; style filiform; ovules very many, placentas axile. *Berry* small, globose, 4-celled, crowned with the calyx-limb. *Seeds* very many, obovoid-oblong, smooth. **DISTRIB.** Species 2; Malayan.

POGONANTHERA PULVERULENTA, Blume in *Flora*, 1831, 521. An epiphytic shrub, all parts (but especially the calyx-tube) bearing pale yellow scales; the stems sparsely lenticellate. *Leaves* rather fleshy, ovate-oblong to oblong-lanceolate, acute or shortly acuminate, the base more or less narrowed and bituberculate, 3-5-nerved; the margins obscurely crenate and slightly reflexed; upper surface glabrous, the lower paler and minutely pulverulent; length 3 to 6.5 in.; breadth 1.75 to 3 in.; petiole .25 to .6 in., stout. *Panicles* terminal, 2 to 3 in. long and equally broad, cymose, the branches spreading. *Calyx-tube* sub-cylindric, constricted below the expanded 4-toothed mouth, very scaly. *Petals* 4, oblong, densely scaly externally. *Stamens* 8; anthers lanceolate, the connective with a tuft of hairs at the base behind. *Fruit* pisiform, .15 in. in diam. Korth. *Verh. Nat. Gesch. Bot.* t. 65; Griff. *Notul.* IV. 678; Miq. *Fl. Ind. Bat.* I, pt. I, 553; Triana in *Trans. Linn. Soc.* XXVIII, 89; C. B. Clarke in *Hook. fil. Fl. Br. Ind.* II, 550; Cogn. in *DC. Mon. Phan.* VII, 610. *P. reflexa*, Blume in *Flora*, 1831, 521; *Mus. Bot. Lugd. Bat.* I, 24; *Naud. Ann. Sc. Nat. Ser.* 3, XV, 303, tab. 15, fig. 1; Triana l.c. 89; Beccari *Malesia*, II, 241, tab. LIX, 4-5. *P. squamulata*, Korth. (ex Blume) *Mus. Bot.* I, 24. *Melastoma reflexa*, Reinw. ined. (ex Blume in *Flora*, 1831, 521). *M. rubicunda*, Jack in *Trans. Linn. Soc.* XIV, 19; *Wall. Cat.* 4086. *M. pulverulenta*, Jack in *Trans. Linn. Soc.* XIV, 19; *DC. Prodr.* III, 149; Blume in *Bijdr.*, 1072.

**SINGAPORE; PERAK; MALACCA; PENANG; common.** **DISTRIB.** Java, Sumatra, Borneo.

I have followed Mr. Clarke in reducing *P. reflexa*, Bl. here, as I can find no tangible character to separate it. *P. reflexa* is said to have white tumid petals not toothed on the margin, while typical *P. pulverulenta* is described as having red petals with a single tooth on each margin. The union of the two species was suggested by Naudin.

#### 15. PACHYCENTRIA, Blume.

Glabrous, often scandent shrubs, with cylindric or obscurely angled, pulverulent branches. *Leaves* somewhat fleshy, oblong or ovate-lanceolate, entire or obscurely crenulate. *Flowers* small, rose-coloured, corymbose, the pedicels 2-bracteolate, 4-merous. *Calyx-tube* ovoid or turbinate, the part beyond the ovary angular, constricted below the obscurely 4-toothed mouth. *Petals* ovate or oblong, subacute or acuminate. *Stamens* 8, equal; anthers linear-oblong or subulate, rostrate at the apex and minutely 1-pored; the connective not produced at the base, inappendiculate in front but minutely spurred at the back. *Ovary* adherent beyond its middle, 4-celled, its apex free, conic, angled; style filiform, the stigma obtuse or capitate. *Berry* globose, crowned by the limb of the calyx. *Seeds* dimidiately obovoid, the raphe lateral. **DISTRIB.** About 12 species, all Malayan.

PACHYCENTRIA TUBERCULATA, Korth. Ver. Nat. Gesch. Bot. 246, t. 63. Epiphytic; branches as thick as a swan's quill, glabrous below but with rusty scurf near the apices, the bark pale; the roots bearing woody tubercles. *Leaves* somewhat fleshy, narrowly elliptic-oblong, subacute, narrowed at the base, the edges entire, 3-nerved; length 2.5-4.5 in.; breadth .9-1.25 in.; petioles .15-.2 in. *Panicles* terminal or axillary, pedunculate; the branches spreading, cymose, 2-2.5 in. long and as wide. *Flowers* .25 in. long, the pedicels shorter. *Calyx-tube* campanulate, the mouth truncate, obscurely 4-lobed. *Petals* 4, lanceolate. *Stamens* 8, equal, shortly spurred at the base behind. *Fruit* globular, glabrous, .15 in. in diam. Blume, Mus. Bot. Lugd. Bat. I, 23; Miq. Fl. Ind. Bat. I, pt. I, 552; Triana in Linn. Trans. XXVII, 89, tab. VII, fig. 95a.

PERAK; *King's Collector* 1707, 10569; *Wray* 3422; *Scortechini* 260, 550, 1961. SINGAPORE; *Anderson* 55. PENANG; *Curtis* 347; *Hullett* 158. **DISTRIB.** Borneo, Burma (Tenasserim, *Griffith*).

#### 16. ASTRONIA, Blume.

*Shrubs* with opposite, petioled, ovate or oblong, entire, 3-nerved leaves. *Flowers* in terminal panicles, small, white or purple. *Calyx-tube* campanulate; limb irregularly truncate or 3-8-lobed. *Petals* 4-5. *Stamens* 8-10-12, equal; filaments short, broad; anthers short, obtuse,



opening by slits down the front, connective spurred at the base or unappendaged. *Ovary* inferior, 2-5-celled, glabrous at the apex; style short, stigma capitellate; ovules numerous, placentas axile, nearly basal. *Capsule* finally breaking up irregularly. *Seeds* very many, linear, raphe excurrent.—**DISTRIB.** Species 24; in Malaya and the Pacific Islands.

**ASTRONIA SMILACIFOLIA**, Triana in Trans. Linn. Soc. XXVIII, 152. Young shoots, petioles, under surfaces of the young leaves and inflorescence rufous-lepidote. *Leaves* oblong, tapering to each end, the transverse nerves stout and distant; length 3·5-5·5 in., breadth 1·5-2·5 in.; petiole ·75-1 in. *Panicle* usually terminal, condensed, 1-2 in. in diam.; branches numerous, short, the pedicels shorter than the globular, minutely 5-toothed calyx-tube. *Petals* reflexed, obovate. *Fruit* subglobular, truncate at the apex, ·25 in. in diam. C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 550; Cogn. in DC. Mon. Phan. VII, 1094. *Melastoma smilacifolia*, Wall. Cat. 4057.

**PENANG**; Wallich, *Curtis*. **MALACCA**; Maingay (K.D.) 808. **PERAK**; *Scortechini* 688; *Wray* 2813.

**VAR. lepidophylla**, Scort. MSS. Arboreous; inflorescence, leaves on the under surface and petioles (when young) densely covered with deciduous scales.

**PERAK**; *Scortechini* 1875; *King's Collector* 7270, 2027.

This variety is described by *Scortechini* and *Kunstler* as a tree 50-80 feet high, the typical form never being more than a large bush.

## 17. **PTERNANDRA**, Jack.

Large shrubs or trees, glabrous or minutely pubescent. *Leaves* sub-coriaceous or coriaceous, opposite, short-petioled or sub-sessile, entire, 3-5-nerved. *Flowers* solitary and axillary on long peduncles, or in axillary or terminal, often very short, and clustered cymes; the pedicels often 2-bracteolate. *Calyx-tube* campanulate or hemispheric, tessellate, verrucose, or covered with more or less adpressed, often puberulous scales; the mouth truncate, often 4-toothed. *Petals* 4, ovate or oblong, blueish or white. *Stamens* 8, equal in length, but the anthers of some of them often imperfect, perfect anthers broad, blunt, shortly spurred behind but never in front, dehiscing by slits, the filaments stout, often geniculate. *Ovary* inferior, 4-celled: the apex glabrous, depressed or flat; style filiform; stigma clavate; ovules numerous, placentas sub-basal. *Berry* subglobose or ovoid, truncate or surmounted by the calyx-teeth, scaly or smooth. *Seeds* cuneate-ovoid, or obovoid, angular.—**DISTRIB.** Species about 12; in Malaya and the Philippines.

- Calyx-tube tessellate outside, not covered with distinct scales ... .. 1. *P. cœrulescens.*
- Calyx-tube covered with large distinct scales :—
- Young branches and under surfaces of leaves rusty-pubescent; calyx-tube 2-3 in. long, covered with more or less spreading scales; teeth of calyx spreading, elongate, acuminate ... .. 2. *P. echinata.*
- Young branches and under surfaces of leaves glabrous; calyx-tube 15 in. long, its scales adpressed; teeth of calyx broadly triangular, blunt, reflexed ... .. 3. *P. Griffithii.*

1. *PTERNANDRA CÆRULESCENS*, Jack in Mal. Misc. II, 61. A tree; young branches cylindric with deciduous, dark-brown, glabrous bark and slightly thickened nodes with obscure transverse ridges. *Leaves* chartaceous or sub-coriaceous, broadly ovate, ovate-lanceolate, ovate-oblong or elliptic, much narrowed at the base, the apex shortly acuminate, 3-5-nerved; both surfaces glabrous; length 2.5-5 in. (10 in. in var. 2); breadth 1.25-2.5 in., (to 5 in. in var. 2) petiole 1-2 in. *Flowers* in short, axillary, pedunculate cymes (often several from one axil), or in terminal cymes, shorter than the leaves. *Calyx-tube* cylindric-campanulate, 15 in. long, tessellate; the mouth truncate but with 4 small, erect, triangular teeth. *Petals* thick, ovate, reflexed after expansion. *Stamens* 8, equal in length; the filaments short, geniculate; perfect anthers 4 or 5, broadly ovate, blunt, shortly spurred behind, the remaining 3 or 4 imperfect, as long as but much narrower than the perfect. *Fruit* turbinate or sub-hemispheric, truncate, nearly smooth, 15-3 in. in diam. Wall. Cat. 4077; Triana in Trans. Linn. Soc. XXVIII, 153; Kurz, For. Fl. I, 509 and in Journ. As. Soc. 1877, pt. II, 79; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 551; Cogn. in DC. Mon. Phan. VII, 1103. *Ewyckia cyanea*, Blume Rumph. I. 24, t. 8; Miq. Fl. Ind. Bat. I, pt. I, 568; Triana l.c. *E. Jackiana*, Walp. Rep. V. 724. *Apteuzis trinervis*, Griff. Notul. IV, 672.—*Nov. Gen.* Roxb. Fl. Ind. II, 225.

In all the provinces except the Andaman Islands.

A common and variable plant of which four forms seem worthy of separation as varieties. These, however, pass into each other by numerous connecting specimens. One variety (*Jackiana*) differs from the typical-plant in having few-flowered almost sessile cymes; a second (*capitellata*) has sub-sessile cymes and much larger leaves and the third (*paniculata*) is probably only an example of fasciation.

VAR. 1. *Jackiana*, Clarke in Fl. Br. Ind. II, 551. *Flowers* in very short, few-flowered, almost sessile, axillary cymes. *Leaves* as in the typical form but with slightly longer petioles.

In all the provinces except the Andaman and Nicobar Islands, equally abundant with the typical form.

VAR. 2. *capitellata*, King. Leaves thicker in texture than in the typical form (sub-coriaceous), broadly elliptic to sub-orbicular, with 3 very strong nerves and a fainter marginal pair; length 4·5–10 in.; breadth 2·75–5 in., petiole 2–3 in. Flowers in dense, very shortly-stalked, axillary glomeruli composed of numerous 3-flowered cymes very much shorter than the leaves. *Pternandra capitata*, Jack in Mal. Misc. II, addenda prefixed to the paper p. 3; Wall. Cat. 4079; W. and A. Prodr. 325; Triana in Trans. Linn. Soc. III, 153; Kurz, For. Fl. I, 509 and in Journ. As. Soc. 1877, pt. II, 79; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 551; Cogn. in DC. Mon. Phan. VII, 1103. *Ewyckia capitellata*, Walp. Rep. V, 724; Miq. Fl. Ind. Bat. I, pt. I, 568. *E. medinillaformis*, Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 261.

SINGAPORE; Wallich 4079. PENANG; Curtis 67; King. PERAK; Scortechini 43, 1043; Wray 1971. MALACCA; Maingay 802 (K.D.); Helfer (K.D.) 2279.

VAR. 3. *paniculata*, King. Flowers in large, lax, terminal, much branched, few-flowered, leafy and bracteolate panicles. Leaves of the stem 2–6 in. long and from 9–2·75 in. broad, those of the panicle from 75–2 in. long and 15–8 in. broad. *P. paniculata*, Benth. in Wall. Cat. 4080; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 551; Cogn. in DC. Mon. Phan. VII, 1104. *Ewyckia latifolia*, Blume Mus. Bot. I, 6. *E. cyanea*, var. *latifolia*, Korth. ex Miq. Fl. Ind. Bat. I, pt. I, 568. *E. paniculata*, Miq. l.c. Suppl. 321. *Pternadra latifolia*, Triana in Linn. Trans. XXVIII, 153.

PENANG; Wallich 4080; Curtis 2768. MALACCA; Griffith (K.D.) 2273. PERAK; Scortechini 248, 1303; Wray 92. DISTRIB.; Borneo, Bangka.

2. *PTERNANDRA ECHINATA*, Jack, Mal. Mis. II, n. 9 and add. prop. 3. A small tree; young branches quadrangular, thickened and with transverse ridges at the nodes, minutely rusty-pubescent. Leaves sub-coriaceous, boldly 3-nerved, lanceolate or oblong-lanceolate, 3-nerved, narrowed to the base, shortly acuminate at the apex; upper surface glabrous; the lower puberulous or sub-glabrous, minutely reticulate; length 2·5–4·5 in.; breadth 75–1·75 in.; petiole 05–2 in. Flowers axillary and solitary on pedicels longer than themselves, or in threes in terminal pedunculate cymes, the pedicels of both sets of flowers with one or more pairs of curved, linear-oblong bracteoles. *Calyx-tube* widely campanulate, 2–3 in. long, closely covered with triangular rusty-pubescent scales, those nearest the mouth longest, most acute, and most persistent; the mouth truncate and with 4 narrow, acuminate teeth. *Petals* broadly ovate-quadrate, abruptly and shortly acute, the edges undulate, blue. *Anthers* broadly ovate, on thick short filaments.

*Fruit* sub-hemispheric, truncate, sub-echinate, .35 in. in diam. Wall. Cat. 4078. *Kibessia echinata*, Cogn. in DC. Mon. Phan. VII, 1108. *Kibessia simplex*, Korth. Verh. Nat. Gesch. Bot. 253; Blume, Mus. Bot. I, 9; Triana in Trans. Linn. Soc. XXVIII, 152; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 552. *Kibessia cupularis*, Dcne in Deless. Ic. Sel. V, t. 5; Ann. Sc. Nat. Ser. 3, XV, 317. *K. acuminata*, Dcne in Ann. Sc. Nat. Ser. 3, V, 316; Triana in Trans. Linn. Soc. XXVIII, 153.

MALACCA and SINGAPORE; not uncommon; many collectors.

I cannot see how *K. acuminata*, Dcne, is to be distinguished as a species and I reduce it here without any hesitation.

VAR. *pubescens*, King. Bases of leaves somewhat rounded and sub-cordate; young branches, under surfaces of leaves and panicles with much minute rusty pubescence. *P. echinata*, Jack, Wall. Cat. 4078a. *Kibessia pubescens*, Dcne in Ann. Sc. Nat. Ser. 3, V, 318; Triana in Linn. Trans. XXVIII, 152; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 552; Cogn. in DC. Mon. Phan. VII, 1108.

PENANG, MALACCA, PERAK.

I cannot see what claim this has to specific rank. To me it appears to be a variety and not a very distinct one of *P. echinata*, Jack. Wallich did not even regard it as a variety and issued it as true *P. echinata*. This form, in the three provinces where it occurs, appears to be very common.

3. PTERANDRA GRIFFITHII, King, n. sp. A small tree; young branches cylindric, very little thickened at the nodes, glabrous. *Leaves* thinly coriaceous, elliptic to ovate-oblong, narrowed at the non-cordate (cordate in var.) base, the apex very shortly acuminate or acute, 3-nerved; both surfaces glabrous, shining; length 2.25-4 in.; breadth 1-2 in.; petiole .15-.2 in. *Flowers* in 2-3- rarely 5-7-flowered, axillary, bracteolate cymes shorter than the leaves, rarely in crowded, terminal cymes; bracteoles ovate, acute, minute. *Calyx-tube* widely campanulate, .15 in. long, covered with adpressed, triangular, puberulous scales; the mouth with 4 large, blunt, triangular teeth. *Petals* orbicular-ovate, undulate, abruptly and shortly apiculate-spreading, not calyptrate. *Stamens* 8, equal; the anthers short, thick, about as long as the filaments, gibbous at the base behind, inserted at an obtuse angle on the filaments. *Fruit* globular-ovoid, truncate at the mouth, covered by the persistent scales, under .2 in. in diam.

MALACCA; Griffith (K.D.) 2272/1; PENANG; Curtis 953.

Griffith's specimens of this (2272/1) have been referred by M. Cogniaux (DC. Mon. Phan. VII, 1110) to *Rectomitra tuberculata* Bl., but comparison in the Kew Herbarium with two authentic specimens of that plant collected in Sumatra and

issued from the Leiden Herbarium shew that this differs from Blume's plant. Specimens of this were originally collected by Griffith in 1845, and as none had been gathered until Curtis's in 1886, the species is presumably a rare one.

**VAR. cordata, King.** Leaves with cordate bases.  
**PENANG; Curtis 453. PERAK; Wray 1994.**

18. **MEMECYLON, Linn.**

*Shrubs or trees, glabrous. Leaves opposite, short-petioled or sessile, coriaceous or sub-coriaceous, orbicular, ovate or lanceolate, entire, pinnate-nerved or rarely 3-nerved. Flowers usually in small, axillary, rarely terminal, simple or paniced cymes or umbels. Calyx-tube campanulate, glabrous; limb dilated, truncate or shortly 4-lobed. Petals 4, blue or white, rarely reddish. Stamens 8, equal, filaments long; anthers short, opening by slits in front, connective ending in a horn behind. Ovary inferior, 1-celled; apex glabrous, surmounted by a convex or depressed disc with 8 radiating grooves; style filiform, simple; ovules 6-12, whorled on a free-central placenta. Berry globose or ellipsoid, crowned with the calyx-margin, 1-seeded. Seed large, cotyledons convolute.—DISTRIB.* Species about 130; numerous in South-East Asia and its islands; a few extending into Polynesia and Australia, several in tropical Africa.

Leaves boldly 3-nerved from base to apex ... .. 1. *M. oligoneuron.*

Leaves with pinnate nervation, sessile or subsessile:—

Main nerves of leaves distinctly visible when dry, inter-  
 arching but not forming (except in No. 3) a bold intra-  
 marginal nerve; leaves thinly coriaceous or membranous,  
 small, not exceeding 4 in. in length:—

Young branches boldly 4-angled or winged; inflo-  
 rescence very shortly stalked (the stalk not manifest):—

Young branches 4-winged:—

Cymes solitary, 3- or 4-flowered; leaves narrowly  
 lanceolate, .6 to 1 in. broad ... .. 2. *M. epiphyticum.*

Cymes solitary, 8- to 10-flowered; leaves ovate- or  
 oblong-lanceolate, 1.35 to 1.85 in. broad ... .. 3. *M. fruticosum.*

Cymes several from the same axil, compoundly  
 umbellate, 1.5 to 2.5 in. long, many-flowered,  
 pubescent; leaves elliptic much narrowed to each  
 end ... .. 4. *M. pubescens.*

Young branches 4-angled, never winged and some-  
 times sub-terete:—

Cymes 3- to 5-flowered: leaves lanceolate, 1 to 2  
 in. broad ... .. 5. *M. dichotomum.*

Young branches terete; inflorescence with a manifest  
 peduncle ... .. 6. *M. Kunstleri.*

Main nerves of leaves distinct when dry, prominent on the lower surface and anastomosing with a bold intra-marginal line, coriaceous, more than 4 in. long :—

Inflorescence manifestly pedunculate :—

Peduncles several in each axil, many-branched ; fruit ellipsoid ... .. 7. *M. caloneuron.*

Peduncles solitary, few-branched ; fruit globular ... 8. *M. Hullettii.*

Inflorescence sessile or on a very short peduncle :—

Flowers large, the mouth of the calyx 2 in. in diam. :—

Arboreous ; leaves sub-acute ; flowers in fascicles of 12 to 20, their pedicels 15 in. long, stout ; calyx truncate, not toothed ... .. 9. *M. Maingayi.*

Shrubby ; leaves acuminate ; cymes 3- or 4-flowered ; pedicels 4 in. long, slender ; calyx-limb 4-toothed 10. *M. Kurzii.*

Flowers small ; mouth of the calyx under 2 in. in diam. :—

Leaves slightly narrowed or rounded at the base, rarely minutely sub-cordate :—

Young branches not winged below the nodes ; main nerves of leaves 18 to 20 pairs ; fruit 7 in. in diam. ... .. 11. *M. heteropleurum.*

Young branches with 4 short wings below each node (sometimes obscure) ; main nerves 12 to 14 pairs ; fruit 35 in. in diam. ... .. 12. *M. costatum.*

Leaves distinctly cordate at the base and quite sessile, amplexicaul ... .. 13. *M. amplexicaule.*

Main nerves of leaves indistinct on both surfaces when dry ; leaves coriaceous or thinly so :—

Leaves with broad cordate bases, sessile, amplexicaul :—

Branches terete, fruit large, globular ... .. 14. *M. microstomum.*

Branches 4-angled ; fruit ellipsoid ... .. 15. *M. coeruleum.*

Leaves much narrowed at the base, never cordate, petiolate :—

Inflorescence in axillary glomeruli or in very shortly-peduncled (not manifest) cymes :—

Mouth of calyx entire in the expanded flower :—

Flowers in fascicles, their pedicels slender ; leaves often 4 in. long ; leaves brown underneath when dry ... .. 16. *M. campanulatum.*

Flowers in short umbellate sub-sessile cymes ; young branches bi-sulcate : fruit globular ; leaves pale yellowish underneath when dry ... 17. *M. minutiflorum.*

Mouth of calyx 4-toothed :—

Teeth of calyx long, sharp, its fundus narrowed ; flower buds narrowly conical ; cymes many-flowered ; fruit globular, 2 in. in diam. ; leaves shortly acuminate, 1.5 to 2.5 in. long ... 18. *M. myrsinoides.*

Teeth of calyx short, acute, its fundus narrow ; cymes few-flowered, fruit globular, 3 in. in diam. ; leaves very acuminate, 2 to 2.5 in. long... 19. *M. laevigatum.*

- Teeth of calyx short, acute, its fundus rounded ;  
 fruit globular, .25 in. in diam. ; flower pedicels  
 with acicular bracteoles ; leaves much acuminate,  
 2.8 to 5.5 in. long ... .. 20. *M. cinereum.*
- Inflorescence manifestly pedunculate :—  
 Fruit ellipsoid :—  
 Young branches terete ; calyx-limb truncate ;  
 leaves elliptic-oblong or elliptic, 2.5 to 4.75 in.  
 long ... .. 21. *M. oleaeifolium.*
- Fruit globular :—  
 Branches 4-angled :—  
 Leaves rhomboid or elliptic-rhomboid ; inflor-  
 escence under .5 in. long ; calyx saucer-shaped  
 with wide, minutely 4-toothed mouth ; fruit .2  
 in. in diam. ... .. 22. *M. pauciflorum.*
- Leaves oblong to elliptic, much tapered to each  
 end ; inflorescences 1 in. or more in length,  
 several in each axil ; calyx with narrow  
 fundus, the mouth wide (.1 in.) and obscurely  
 4-toothed ; fruit .5 in. in diam. ... .. 23. *M. elegans.*
- Branches terete :—  
 Mouth of calyx with 4 broad, shallow teeth ;  
 flowers 4 to 6 in a compound umbel ; fruit .25  
 in. in diam. ; leaves caudate-acuminate ... .. 24. *M. acuminatum.*
- Mouth of calyx truncate or with 4 obscure  
 teeth :—  
 Cymes many-flowered, on peduncles not  
 longer than the leaf-petioles ; calyx with  
 wide, obscurely toothed mouth and narrow,  
 cup-shaped tube ; young branches not bi-sul-  
 cate ... .. 25. *M. gareinioides.*
- Cymes or peduncles very slightly if at all  
 longer than the petioles ; calyx not toothed ;  
 young branches deeply bi-sulcate under the  
 nodes ... .. 26. *M. andamanicum.*
- Cymes or peduncles several times longer  
 than the leaf-petioles :—  
 Peduncles solitary ; leaves thinly coria-  
 ceous ... .. 27. *M. intermedium.*
- Peduncles several from the same axil ;  
 leaves coriaceous ... .. 28. *M. edule.*

1. MEMECLON OLIGONEURON, Blume, Mus. Bot. I, 354. A small tree or shrub ; young branches slender, terete, their bark pale-brown. *Leaves* thinly coriaceous, brown below, greenish brown above when dry, oblong to ovate- or elliptic-oblong, shortly and obtusely acuminate, boldly 3-nerved from the cuneate base, transverse nerves invisible ; length 2-4 in. ; breadth 1.3-1.65 ; petiole .05-.15 in. *Flowers* small

(.05 in. long), on pedicels about .1 in. long, densely crowded in clusters on small tubercles in the axils of leaves or of fallen leaves. *Calyx-tube* cupular, but little contracted at the base, the mouth wide with four broad shallow teeth. *Fruit* unknown. Miq. Fl. Ind. Bat. I, pt. 1, 574; Cogn. in DC. Mon. Phan. VII, 1132. *M. trinerve*, Hassk. Cat. Hort. Bog. 259 (not of DC.). *Myrtus oligoneura*, Korth. ex Blume l.c. 354.

PERAK; *Scortechini* 1309; *King's Collector* 2513, 10280. PENANG; *Curtis* 1065, 1446, 2220, 10920. DISTRIB. Java, Borneo.

A species easily recognised by its 3-nerved leaves.

2. *MEMECYLON EPIPHYTICUM*, King, n. sp. An epiphytic shrub; branches rather stout, strongly angled and with short ear-like projections just below the nodes. *Leaves* thinly coriaceous, narrowly oblong-lanceolate, acute or acuminate, somewhat narrowed to the rounded sub-cordate base; main nerves 9 or 10 pairs, indistinct on the lower surface, invisible on the upper; length 1.75–3 in.; breadth .6–1 in.; petiole .05 in. *Cymes* in pairs, axillary, 3–4-flowered, on slender pedicels .1–.15 in. long, bracteate at the apex; pedicels half as long as the peduncle. *Calyx-tube* cupular, rounded at the base; the mouth deep and wide (.05 in. across), undulate, truncate. *Fruit* globular, smooth, .25 in. in diam.

PERAK; on trees, *King's Collector* 5184; *Wray* 2727.

A species allied to *M. dichotomum*, Clarke, but with smaller leaves, more boldly angled branches, smaller, less numerous flowers, and cymes on more slender peduncles.

3. *MEMECYLON FRUTICOSUM*, King, n. sp. A shrub, 6–8 feet high; young branches boldly 4-winged especially near the slightly thickened nodes, the bark pale-brown. *Leaves* ovate-lanceolate or oblong-lanceolate, chartaceous, shortly acuminate, slightly narrowed to the rounded base; main nerves 7–9 pairs, interarching .15 in. from the margin, somewhat conspicuous on the lower but indistinct on the upper surface; length 3–4 in.; breadth 1.35–1.85 in.; petiole .05 in. *Cymes* usually in pairs, axillary, on short peduncles, 8–10-flowered. *Flowers* on pedicels with acute bracteoles at their bases. *Calyx-tube* shortly campanulate, tapering much to the base (obconic), the mouth .075 in. wide, with 4 shallow obscure teeth, or truncate; the buds not very conical. *Fruit* globose-ovoid, constricted below the thick persistent calyx-limb, .35 in. long and .25 in. in diam. (unripe).

PERAK; *King's Collector* 2971, 3265, 3425.

Approaching *M. dichotomum* and *M. sub-dichotomum* but with differently shaped fruit.

4. *MEMECYLON PUBESCENS*, King. A tree, 30–70 feet high; young branches somewhat slender, pale-brown, 4-angled. *Leaves* coriaceous,



elliptic, shortly and abruptly acuminate, the base much narrowed; yellowish green on the lower surface and olivaceous on the upper when dry; main nerves 7-10 pairs, quite distinct on the lower surface, less so on the upper, curved and interarching .1 in. from the margin. *Cymes* 1-3 from the axils of leaves, often unequal, proliferously umbellate, from 1.5-2.5 in. long, always pedunculate, the peduncle and all its branches 4-angled, bracteolate at the divisions, sparsely and deciduously rusty-pubescent. *Flowers* densely clustered at the apices of the thickened secondary peduncles, pedicellate; the pedicels with numerous sharply acuminate bracteoles at their bases. *Calyx-tube* campanulate, much narrowed at the base, the mouth rather more than .05 in. wide, truncate but with 4 minute, acicular teeth. *Fruit* globular, .15 in. in diam. (unripe). *M. grande*, Retz., var. *pubescens*, Clarke in Hook. fil. Fl. Br. Ind. II, 558; Cogn. in DC. Mon. Phan. VII, 1153.

MALACCA; *Griffith* (Kew Distrib.) 2336. PERAK; *King's Collector* 6089, 10760. SINGAPORE; *Ridley* 10390.

Ripe fruit of this is unknown.

5. MEMECYLON DICHOTOMUM, C. B. Clarke in Herb. Kew. A slender shrub, 6-8 feet high; young branches slender, acutely 4-angled (even 4-winged) below the slightly thickened nodes; the bark pale-brown. *Leaves* thinly coriaceous, almost sessile, lanceolate to ovate-lanceolate, much acuminate, often caudate; the base rounded or slightly narrowed; main nerves 6-8 pairs, curved, interarching rather far from the margin, often indistinct; length 2.5-4 in.; breadth 1-2 in.; petiole very short (under .05 in.). *Cymes* 2-5-flowered, solitary, axillary and terminal; peduncles very short, 4-angled; pedicels with two ovate, acute bracteoles at their apices embracing the calyx. *Calyx-tube* campanulate, tapering to the base (obconical); minutely glandular outside when dry, the mouth with 4 broad, shallow lobes when young, truncate and almost entire when old; buds rather large, conical. *Fruit* globular, crowned by the narrow calyx-limb, smooth when ripe, about .5 in. in diam. *M. elegans*, var. *dichotoma*, C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 554; Cogn. in DC. Mon. Phan. VII, 1138.

MALACCA; *Griffith* (Kew Distrib.) 2324; *Maingay* (K.D.) 818, 820. PERAK; *Wray* 2989; *King's Collector* 3239, 5036, 5297, 10783. PAHANG; *Ridley* 2609.

I restore for this species the MS. name originally given to it by Mr. C. B. Clarke in the Kew Herbarium. Mr. Clarke subsequently reduced it, as a variety, to *M. elegans*, Kurz, of which there were, at the time he made the reduction, no good specimens. Now that there are excellent examples of *M. elegans*, it is clear that *M. dichotomum* is not near that species.

There are specimens in the Calcutta Herbarium of what appear to be other species allied to this. But the material of all is imperfect and I describe none of them.

6. *MEMEYLON KUNSTLERI*, King, n. sp. A tree, 40–60 feet high; young branches slender, terete, very pale-grey. *Leaves* chartaceous, drying brown (palest on the lower surface), elliptic-oblong, bluntly acuminate, the base rounded and often minutely cordate; main nerves 7 or 8 pairs, ascending, faint on the lower and almost invisible on the upper surface when dry; length 2·75–4·5 in.; breadth 1–2 in.; petiole ·05–·1 in. *Peduncles* from the axils of fallen leaves or axillary, bracteolate, ·35–·6 in. long, umbellately paniced, bracteolate at the divisions, 4-angled like the pedicels; ultimate umbels 4–6-flowered, on the thickened ends of the secondary peduncles, pedicels bracteolate at the base. *Calyx-tube* cup-shaped, shallow, the mouth obscurely 4-toothed. Young fruit ellipsoid, crowned by the thick, shallow, obscurely 4-toothed limb of the calyx, ·3 in. long, and ·15 in. in diam.

PERAK; *King's Collector* (Kunstler) 8195, 10419.

This is known only by Mr. Kunstler's two suites of specimens. One of these sets bears no fruit; the other no flowers. The leaves on the former are rather smaller than those on the second but the venation is the same and I assume that they belong to one species. The terete branchlets, associated as they are with an inflorescence which is 4-angled in all its branches, even down to the pedicels and the ellipsoid fruit, distinguish the plant.

7. *MEMEYLON CALONEURON*, Miq. Fl. Ind. Bat. Suppl. 321. A tree; branchlets and leaves as in *M. costatum*, Miq., but the latter with fewer nerves. *Flowers* in axillary, pedunculate, many-branched cymes, 1–2 in. long, the flowers in dense glomeruli on the thickened apices of the ultimate branchlets; all the peduncles boldly 4-angled or winged; fruit ellipsoid, ·35 in. long (including the small persistent calyx-limb). *M. costatum*, Miq., var. *ellipsoidea*, Blume Mus. Bot. I, 361; Cogn. in DC. Mon. Phan. VII, 1136.

MALACCA; *Maingay* (Kew Distrib.) 813. PERAK; *Wray* 3235; *King's Collector* 6945, 8505. DISTRIB. Java; Sumatra, *Forbes* 2696; Borneo.

The inflorescence and fruit are so different from those of *M. costatum*, Miq., that I have followed Miquel in treating this as a species. Miquel did not however, recognise that his *M. caloneuron* really covers Blume's variety *ellipsoidea* of his own species *M. costatum*.

8. *MEMEYLON HULLETHII*, King, n. sp. Young branches slightly ridged near the nodes, otherwise terete, the bark pale-brown. *Leaves* chartaceous, ovate-oblong, gradually narrowed to the acuminate apex; the base broad, abruptly rounded, slightly cordate; main nerves about 15 pairs, thin but distinct on the lower surface, horizontal; length 6–8 in.; breadth 2·25–3 in.; petiole under ·1 in. *Peduncle* solitary, axillary, 1·5–2·5 in. long, slender, bearing at its apex a single or compound

few-flowered umbel; the flower-pedicels longer than the calyx and, like the peduncles of the secondary umbels, rugulose. *Calyx-tube* campanulate, narrowed to the base; the mouth truncate, with 4 very obscure shallow teeth. *Fruit* globular, crowned by the rather large calyx-limb, .25 in. in diam. (not quite ripe).

JOHORE; on Gunong Pulai, *Hullett and King* 253; *Lake and Kelsall* 4073.

A very well-marked species near *M. amplexicaule*, Roxb., at once distinguished by its elongately acuminate, broad-based leaves and long-peduncled umbels.

9. *MEMECYLON MAINGAYI*, Clarke in Hook. fil. Fl. Br. Ind. II, 557. A tree, 20–40 feet high; branches stout, terete, somewhat thickened at the nodes, the bark pale-brown when dry. *Leaves* coriaceous, nearly sessile, elliptic-oblong, sub-acute, slightly narrowed to the rounded, sometimes slightly cordate base; in length 6.5–9 in.; breadth 3–4.25 in.; main nerves 12–15 pairs, not very prominent, interarching inside the margin. *Flowers* large for the genus, in few-flowered (12–20) fascicles from the axils of the leaves or of fallen leaves; peduncles and pedicels about .15 in. long, bracteolate. *Calyx-tube* widely cupular, truncate, toothless, .2 in. in diam. when dry. *Petals* obtuse in bud. *Fruit* unknown. Cogn. in DC. Mon. Phan. VII, 1139.

MALACCA; *Maingay* (Herb. prop.) 1422. PERAK; *King's Collector* 4726.

An arboreal species with large flowers and thick branches, allied to *M. amplexicaule* but well distinct.

10. *MEMECYLON KURZII*, King. A glabrous shrub; young branches terete, swollen under the nodes, the bark pale when dry. *Leaves* thinly coriaceous, sub-sessile, ovate-oblong, shortly acuminate, slightly narrowed to the rounded base; main nerves 15–20 pairs, rather straight, interarching .25 in. from the margin, faint; length 8.5–10 in.; breadth 3.25–4.5 in.; petiole about .1 in. long, stout. *Flowers* large, on slender bi-bracteolate pedicels .4 in. long; the cymes 3- or 4-flowered, from the axils of fallen leaves, solitary or several together; peduncle short (only .15 in. long). *Calyx-tube* campanulate, .2 in. long; the mouth .2 in. wide, wavy and with 4 broad teeth. *Fruit* ellipsoid, somewhat curved, .75 in. in length (including the persistent limb of the calyx) and .4 in. in diam. *M. subtrinervium*, Miq., var. *grandiflora*, Kurz in Journ. As. Soc. Beng. 1876, pt. II, 131; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 565; Cogn. in DC. Mon. Phan. VII, 1143.

NICOBAR ISLANDS; *Kurz, King's Collector* 509.

The leaves of this when dry are pale-brown on the upper and pale-olivaceous on the lower surface. They are different in shape from those of *M. subtrinervium*, Miq., of which Kurz makes this a variety. The flowers of the latter are moreover small and in slender pedunculate cymes.

11. *MEMECYLON HETEROPLEURUM*, Blume, Mus. Bot. Lugd. Bat. I, 362. A tree, 30 and 40 feet high; young branches rather slender, terete, the bark pale-brown or cinereous when dry. *Leaves* thinly coriaceous, broadly oblong-lanceolate or elliptic-oblong, shortly and rather bluntly acuminate, the base rounded or narrowed, not cordate, shortly petiolate, pale-brown with sometimes a touch of green on both surfaces when dry; main nerves 18–20 pairs, straight, interaching close to the margin, thin but very distinct on the lower surface when dry; length 5–7 in. rarely 10 in.; breadth 2–3·5 in.; petiole only ·1 in. *Flowers* pointed in bud, in dense cymes from the axils of the leaves or from those of the old leaves; the peduncle ·25 in. long; pedicels shorter, bi-bracteolate. *Calyx-tube* widely cupular, narrowed to the base, truncate, ·1–1·5 in. in diam. when dry. *Fruit* globular, ·5 in. in diam. Miq. Fl. Ind. Bat. I, pt. I, 579; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 557; Cogn. in DC. Mon. Phan. VII, 1140.

MALACCA; *Griffith* 2337 (Kew Distrib.); *Maingay* (K.D.) 816. PENANG; *Curtis* 814. SINGAPORE and SELANGORE; *Ridley*. PERAK; *King's Collector*, *Wray*, *Scortechini*: many Nos.; common. DISTRIB. Sumatra and Borneo.

VAR. *olivacea*, King. Leaves rounded at the base, large, 10–14 in. long and 3·5–4·25 in. broad, with a strong olivaceous tint when dry; fruit not seen.

PERAK; *King's Collector* 500, 2778, 10872; *Wray* 1310.

This variety differs (as far as it is represented by dried specimens) from typical *M. heteropleurum*, Bl., only in the size of its leaves and their colour when dried; fruit of it is unknown, the flowers and shape of leaves are exactly those of the type.

12. *MEMECYLON COSTATUM*, Miq. in Verb. Ned. Inst. 1850, p. 29. A tree, 30–60 feet high; young branches terete, but with 4 short wings below the nodes. *Leaves* thinly coriaceous (drying pale-brown with a tinge of yellowish-green), oblong- or oblong-lanceolate, sometimes oblong-ovate, shortly acuminate, the base rounded or slightly narrowed, not cordate, penni-nerved; the main nerves 12–14 pairs, stout, curved, anastomosing at ·25 in. from the margin with a bold lateral nerve; length 4·5–7·5 in.; breadth 1·75–3 in.; petiole very short, stout. *Flowers* crowded in axillary glomeruli, 1 in. or less in diameter; their pedicels short (·1–0·5 in.), the bracteoles minute, triangular. *Calyx* cup-shaped, truncate, slightly narrowed at the base. *Petals* ·2 in. in diam. *Fruit* globose, ·35 in. in diam. Miq. Fl. Ind. Bat. I, pt. I, 573; Triana in Linn. Trans. XXVIII, 157; Blume, Mus. Bot. I, 360; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 558; Cogn. in DC. Mon. Phan. VIII, 1136. *M. grande*, Bl. Bijdr. 1095 (not of Retz.).

PERAK; *King's Collector* 10785. DISTRIB.; Java, Sumatra (*Forbes* 1442).

13. *MEMECYLON AMPLEXICAULE*, Roxb. Fl. Ind. II, 260. A shrub, 8–12 feet high; branches rather slender, terete between, but 4-angled and sometimes 4-winged below the nodes. *Leaves* (tinged with greenish-yellow when dry) sessile or nearly so, often semi-amplexicaule, ovate-oblong or ovate-lanceolate, sub-acute or shortly and bluntly acuminate, broadest a little above the cordate base, penni-nerved; the main nerves 9–12 pairs, not prominent, interaching inside the margin; length 3·5–6 in.; breadth 1–2·5 in. *Flowers* 2 in. long, crowded in dense, axillary glomeruli 1 in. or less in diameter; their pedicels very short (lengthened to 25 in. in fruit) and with minute bracteoles. *Calyx* campanulate, truncate, much narrowed to the base. *Petals* sub-rotund, 2 in. in diam. *Fruit* globose, 3 in. in diam. Wight Ic. 279. Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 277; Miq. Fl. Ind. Bat. I, pt. I, 580; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 559 (in part); Cogn. in DC. Mon. Phan. VII, 1139 (in part). *M. depressum*, Benth. in Wall. Cat. 4101 (in part); Triana in Linn. Trans. XXVIII, 158 (in part). *M. cordatum*, Wall. Cat. 4100 (in part). *M. coeruleum*, Triana in Linn. Trans. XXVIII, 158 (in part).

In all the Provinces except the Andaman and Nicobar Islands; common.

The petals of this are white tinged with pink. The plant described by Roxburgh under the name *M. amplexicaule* is a Malayan one, as he distinctly states. The species from the South of India which has, in most of the synonyms above quoted, been treated as identical with this is, in my opinion, quite distinct. It has smaller and proportionately broader leaves, and the flowers, which are smaller and more numerous, are in fascicles from the axils of fallen leaves. This is allied to *M. costatum*, and like it, this has the stems often 4-winged below the nodes; the leaves are also sessile or nearly so, but they differ from those of *M. costatum* in invariably being cordate at the base.

14. *MEMECYLON MICROSTOMUM*, Clarke in Hook. fil. Fl. Br. Ind. II, 557. A tree, 40–70 feet high; branches terete, rather slender, dark greyish-brown when dry. *Leaves* very coriaceous, sessile and almost amplexicaul, oblong or narrowly elliptic, sub-acute or obtuse, the base rounded and slightly cordate, very opaque, the nerves very indistinct; length 3·25–4·5 in.; breadth 1·3–2 in. *Flowers* numerous, small, less than 1 in long (excluding the exerted stamens), crowded in dense axillary glomeruli, pedicels filiform. *Calyx-tube* infundibuliform, constricted in its lower third, the mouth wide truncate. *Petals* pale yellowish-green. *Fruit* large (6 in. in diam.), globular, the persistent calyx-limb small. Cogn. in DC. Mon. Phan. VII, 1147.

MALACCA; *Maingay* (Kew Distrib.) 821; PERAK; *Wray* 1137; *King's Collector* 10588. SINGAPORE; *Ridley* 2033. PENANG; *Curtis* 766.

The leaves of this, when dry, are olivaceous on the upper and pale-brown on the lower surface. The species resembles *M. amplexicaule* but differs notably in its large globular fruit.

15. *MEMECYLON COERULEUM*, Jack. in Mal. Misc. I, 26. A shrub, 5-15 feet high; branchlets often 4-angled near the apices, otherwise terete, slender, the bark pale-brown when dry. *Leaves* sessile, coriaceous, opaque, oblong or ovate-oblong, obtuse or sub-acute, broadest a little above the rounded, cordate base, the midrib distinct but the main nerves faint and the reticulations obsolete; length 2.5-4.75 in.; breadth 1-2.5 in. *Flowers* rather numerous, in dense, axillary, condensed glomerulate cymes, the peduncle .25 in. long, the pedicels shorter than the flowers, each with two broad, acute bracteoles. *Calyx-tube* short, widely campanulate, narrowed to the base, the mouth wide truncate. *Petals* conical in bud. *Fruit* narrowly ellipsoid, .4 in. long and .25 in. in diam. (including the deep, persistent calyx-limb). Miq. Fl. Ind. Bat. I, pt. I, 580; Triana in Linn. Trans. XXVIII, 158 (excl. syn. *M. amplexicaule*, Roxb.); Kurz, For. Flora B. Burma I, 511; C. B. Clarke in Hook. fil. Fl. Br. Ind. I, 559; Cogn. in DC. Mon. Phan. VII, 1163. *M. grande*, Smith in Rees' Cyc. XXIII (not of Retz). *M. cordatum*, Wall. Cat. 4100 (partly); Griff. Not. IV, 673. *M. manillanum*, Naud. in Ann. Sc. Nat., Ser. 3, XVIII, 276; Miq. l.c. 576. *M. lutescens*, Presl. Epim. Bot. 208 (not of Naud.).

In all the provinces; not uncommon. **DISTRIB.** Philippines.

16. *MEMECYLON CAMPANULATUM*, Clarke in Hook. fil. Fl. Br. Ind. II, 563. Young branches rather slender, terete, their bark pale-brown. *Leaves* coriaceous, elliptic, sometimes with a short blunt apical point, the base always much and abruptly narrowed, nerves invisible; length 3-4.5 in.; breadth 1.25-2.2 in.; petiole .1-.15 in. *Flowers* on slender pedicels, .1-.15 in. long, bracteolate at the base and crowded in dense fascicles in the axils of the leaves or of the fallen leaves, the buds of the petals shortly conical. *Calyx-tube* campanulate, blunt at the base and somewhat contracted below the wide truncate limb. *Fruit* unknown. Cogn. in DC. Mon. Phan. VII, 1162.

MALACCA; *Griffith* (Kew Distrib. 2325).

In its leaves this much resembles *M. oleafolium*, Bl., but the flowers of that species are in lax, few-flowered, pedunculate umbels, whereas the flowers of this are in dense, epedunculate fascicles.

17. *MEMECYLON MINUTIFLORUM*, Miq. Fl. Ind. Bat. Suppl., 323. A tree, 30-70 feet high; young branches slender, with a broad, angularly margined groove on each side; the bark pale, smooth. *Leaves* thinly coriaceous, drying yellowish-green beneath, narrowly elliptic, cordate-acuminate, the base much narrowed; main nerves very indistinct.

*Inflorescence* twice as long as the petioles, many-flowered; the peduncles often two or three from the same axil, each bearing several 2-4-flowered umbels; pedicels stout, bracteolate at the base. *Calyx-tube* cup-shaped, not tapered to the base, the mouth expanded, truncate and .05 in. wide, glandular-hairy when young like the bluntly conical petal-bud and the pedicels. *Fruit* crowned by the minute calyx-limb, depressed globular, smooth, .35 in. in diam. and .3 in. deep. Cogn. in DC. Mon. Phan. VII, 1169. *M. acuminatum*, Sm., var. *flavescens*, Clarke in Hook. fil. Fl. Br. Ind. II, 562; Cogn. in DC. Mon. Phan. VII, 1152.

MALACCA; *Griffith* (Kew Distrib.) 2325/2. PENANG; *Curtis* 815. PERAK; *King's Collector* 5027, 6105, 6265, 8724. DISTRIB. Sumatra.

Triana considers this a distinct species and I think he is right. *Fruit* however is wanting to complete our knowledge of the form. The Perak specimens agree perfectly with the type sheet named *M. minutiflorum*, Miq., in Herb. Calcutta. The species is not, as was suggested by Kurz, identical with *M. lilacinum*, Zoll. and Moritzi.

18. MEMECYLON MYRSINOIDES, Blume, Mus. Bot. I, 356. A tree, 30-40 feet high (rarely a shrub); young branches terete, slender, with pale-grey bark. *Leaves* thinly coriaceous, drying brown (palest on the lower surface), narrowly elliptic or ovate-lanceolate, the apex very acuminate, much narrowed to the cuneate base; main nerves invisible on both surfaces; length 1.5-2.5 in.; breadth .9-1.25 in.; petiole .15-.25 in. *Flowers* numerous, in very short-peduncled cymes, densely clustered together in the same axil; pedicels about the length of the calyx, bracteolate at the base. *Calyx-tube* campanulate, much narrowed to the base, the mouth less than .05 in. wide, with 4 long (for the genus) acute teeth; *petals* in bud forming a long narrow cone, acuminate. *Fruit* globular, the size of a grain of black pepper. Miq. Fl. Ind. Bat. I, pt. I, 577; Triana in Linn. Trans. XXVIII, 158 (excl. syn.); Cogn. in DC. Mon. Phan. VII, 1160; excl. syn. *M. lilacinum*. *M. capitellatum*, Blume, Bijdr. 1091 (not of Linn.).

PENANG; *Curtis* 2219. JOHORE; *Ridley* 2026. PERAK; *Wray* 2258; *King's Collector* 1851, 3517, 5923, 8828. DISTRIB.; Sumatra; *Forbes* 2953; Java; Bangka.

VAR. *lilacina*, King. Young branches with two deep, sharply-margined grooves; leaves broadly elliptic, yellowish on the under surface when dry, cymes not crowded (only two in an axil). *M. lilacinum*, Zoll. & Mor. Syst. Verzeich., 9; Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 281; Miq. Fl. Ind. Bat. I, pt. I, 575.

PENANG; *King's Collector* 1457; *Curtis* 100. SINGAPORE; *Ridley* 6218. PERAK; *King's Collector* 10442. DISTRIB.; Java, *Zollinger* 178.

19. *MEMECYLON LAEVIGATUM*, Blume, Mus. Bot. Lugd. Bat. I, 358. A small tree; young branches very slender, terete, the bark pale. *Leaves* thinly coriaceous, broadly ovate or elliptic, more or less rostrate-acuminate, the base cuneate; main nerves obscure; length 2-2.5 in.; breadth 1-1.75 in., petiole .1-1.15 in., opaque, when dry dull dark-brown, the lower surface slightly paler than the upper. *Cymes* mostly from the nodes of fallen leaves, small, few-flowered, the peduncle very short (.1 in. long), pedicels also very short. *Flowers* small (less than .1 in. long), their buds pointed; *calyx-tube* campanulate, much tapered to the base, the mouth with 4 acute, small teeth. *Fruit* globular, .3 in. in diam., smooth. Miq. Fl. Ind. Bat. I, pt. I, 576; Triana in Linn. Trans. XXVIII, 157; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 561 (excl. VARS.); Kurz, For. Flora. I, 513; Cogn. in DC. Mon. Phan. VII, 1159. *M. Myrilli*, Blume, Mus. Bot., 357; Miq. l.c. 578. *M. pachyderma*, Wall. Cat. 4104. *M. Vosmaerianum*, Scheff. in Flora, 1870, 249.

MALACCA; *Ridley* 1707. SINGAPORE; *Ridley* 1815, 1906, 2026, 4805. PERAK; *Scortechini* 81; *Wray* 2091; *King's Collector* 3768. SELANGORE; *Ridley* 2024. DISTRIB.; Burma, *Helfer* 2328; *Wallich* 4104; Bangka, Java, Borneo.

20. *MEMECYLON CINEREUM*, King, n. sp. A shrub; young branches rather slender, terete, sulcate on two sides, the bark dark-cinereous when dry. *Leaves* coriaceous, drying very dark cinereous-brown on the upper surface, somewhat paler on the lower, lanceolate or ovate-lanceolate, much acuminate, the base rounded but more often cuneate; main nerves 8-10 pairs, invisible on both surfaces or nearly so, length 2.8-5.5 in.; breadth 1-2.2 in.; petiole .15-3 in. *Peduncles* axillary or from the leafless nodes, not much longer than the petioles, glomerulate, many-flowered; pedicels short, stout, with small acicular bracteoles at the base. *Calyx-tube* cupular, with a rounded base; the mouth expanded, .1 in. wide, undulate and with 4 acute, triangular teeth. *Fruit* globular, the persistent calyx-limb small, .25 in. in diam., smooth.

PERAK; *Scortechini* 394, 2035; *King's Collector* 3143, 10758.

21. *MEMECYLON OLEAEFOLIUM*, Blume, Mus. Bot. I, 359. A tree, 30-60 feet high; young branches rather slender, terete, smooth, the bark very pale. *Leaves* coriaceous, elliptic-oblong or elliptic, the apex obtusely acuminate, the base much narrowed, when dry of a pale olivaceous-brown colour on both surfaces, the upper the darker; main nerves 8-10 pairs, obscure; length 2.5-4.75 in.; breadth 1-2.25 in.; petioles .15 to .3 in. *Peduncles* 1-3 in one leaf-axil, several times longer than the petiole (elongating in fruit), bearing at the apex



numerous, crowded, 2-3-flowered umbellules with a semi-circular bract at the bases of their short, stout, 4-angled peduncles. *Flowers* with conical buds, less than .1 in. in diam., on slender pedicels longer than themselves, bracteolate at their bases. *Oalyx* hemispheric; the mouth truncate, entire. *Fruit* ovoid-elliptic, crowned by the short calyx-limb, .4 long and .25 in. in diam. Miq. Fl. Ind. Bat. I, pt. I, 579 (excl. syn.); Cogn. in DC. Mon. Phan. VII, 1150. *M. Horsfieldii*, Miq. Fl. Ind. Bat. I, pt. I, 572. *M. grande*, Retz, var. *Horsfieldii*, Clarke in Hook. fil. Fl. Br. Ind. II, 558; Cogn. in DC. Mon. Phan. VII, 1153 (excl. syn. *M. celastrinum*, Kurz from both). *M. lampongunum*, Miq. Fl. Ind. Bat. Suppl. 321.

MALACCA; *Maingay* (Kew Distrib.) 811. SINGAPORE; *Ridley* 6414. PERAK; *Scortechini* 2069; *King's Collector* 426, 5187, 4420, 4439, 8571. DISTRIB. Bangka; *Horsfield*; Sumatra; *Forbes* 3213.

This has been treated by Messrs. Clarke and Cogniaux as a variety of *M. grande* of Retz, a species originally described by its author from specimens sent to him by Koenig, who collected in Southern India. Retz's description is very short and, as Mr. Clarke points out, would suit several species. The species of *Memecylon* have not, as a rule, a wide distribution, and very few indeed of them are common to S. India or Ceylon and to the Malay Peninsula. I think it, therefore, in the absence of his type specimen, advisable to consider Retz's name as properly belonging to the Ceylon plant represented by Thwaites's C.P. 8442. Both Messrs. Clarke and Cogniaux treat as belonging to typical *M. grande*, Retz, the Singapore plant issued by Wallich as No. 4472 of his Catalogue under the name *M. lasiiflorum*. This plant is now represented only by fruiting specimens which do not, in my opinion agree with any other *Memecylon* in Herb. Kew. The inflorescence in Wallich's specimens is 2.5 in. long, pedunculate, and laxly compound-umbellate. When flowers shall be forthcoming it will probably be found necessary to let the species *M. lasiiflorum* stand good.

Thwaites's C.P. which I assume, in the absence of a type specimen, to be equal to the type of *M. grande*, Retz, does not in my opinion resemble the four forms which the two distinguished botanists just mentioned agree in treating as varieties of it, sufficiently closely to warrant such treatment of the latter. I would venture to dispose of them as follows:—

VAR. *Horsfieldii* = *M. oleaefolium*, Bl. VAR. *khasiana* = *M. celastrinum*, Kurz.

VAR. *pubescens* = *M. pubescens*, King. VAR. *merguica* = *M. merguica*, King.

*M. Cogniaux* has inadvertently described the fruit of *M. oleaefolium* as globose, whereas in his original description of it Blume writes "*fructibus ellipsoideis*."

22. MEMECYLON PAUCIFLORUM, Blume, Mus. Bot. I, 356. A small tree; young branches 4-angled, slender, pale-brown. *Leaves* coriaceous, rhomboid or elliptic-rhomboid, drying brown, the lower surface paler, the apex blunt and often retuse, the base acute or subacute; nerves 6 or 7 pairs, invisible or very faint; length 1-1.5 in.; breadth .35-1 in.; petiole under .1 in. *Cymes* umbellate, axillary, on slender peduncles .1-.2 in. long; flowers 7-10, small, on slender pedicels bracteolate at the base

and about .15 in. long. *Calyx-tube* shortly campanulate, or saucer-shaped, with a large, wide, sharply and minutely 4-toothed mouth. *Petals* acuminate. *Stamens* and style much exserted. *Fruit* depressed-globular, smooth, crowned by the toothed calyx, .2 in. in diam. Miq. Fl. Ind. Bat. I, pt. I, 578; Kurz, For. Flora Burma I, 514; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 555; Cogn. in DC. Mon. Phan. VII, 1169. *M. capitellatum*, Spanoghe in Linnaea, XV, 203 (not of Linn.). *M. umbellatum*, Benth. Fl. Austral III, 293 (non Burm.). *M. australe*, Muell. ex Triana in Linn. Trans. XXVIII, 159.

ANDAMAN ISLANDS; very common. DISTRIBUTION. Burma (*Helfer 2332*); Chittagong; Australia; Timor.

The Penang specimens have narrower, less rhomboid leaves than those from the Andamans.

23. MEME CYLON ELEGANS, Kurz in Journ. As. Soc. Beng. 1872, pt. II, 307. A glabrous shrub; young branches slender, boldly 4-angled, sometimes winged, the bark pale. *Leaves* coriaceous, pale yellowish, the upper surface tinged with green when dry, oblong to elliptic, much acuminate, the base very cuneate; main nerves invisible or very indistinct; length 3.5-5.5 in.; breadth 1.4-2 in.; petiole .15-.3. *Flowers* .15 in. long, their pedicels longer, (.2 in.), slender, angled. *Cymes* axillary, several together, pedunculate, simply or trichotomously umbellulate; peduncles .3-.75 in. long, 4-angled. *Calyx-tube* somewhat large for the genus, cup-shaped, narrowed to the base, .1 in. wide at the undulate, obscurely 4-lobed mouth. *Petals* blue, broadly ovate, acuminate. *Fruit* globular, smooth, .5 in. in diam. Kurz, For. Flor. Burma I, 514; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 554; Cogn. in DC. Mon. Phan. VII, 1138.

ANDAMAN ISLANDS; very common.

VAR. *minor*, King. *Cymes* usually solitary, the pedicel slender, short; fruit only .2 in. in diam. (? ripe); leaves 2-3 in. long.

ANDAMANS; *King's Collectors*.

Smaller than the typical form in all its parts. The flower buds also differ somewhat from those of the typical form.

24. MEME CYLON ACUMINATUM, Smith in Rees Cyclop. XXIII, 4. A tree, 30-50 feet high; young branches slender, terete, the bark brown, smooth. *Leaves* thinly coriaceous, drying pale olivaceous-brown, the surfaces concolourous, ovate to ovate-lanceolate, caudate-acuminate, the base cuneate; main nerves invisible; length 1.5-2.25 in.; breadth .8-1.4 in.; petiole .1-1.5 in. *Cymes* solitary or in pairs, axillary, umbellate, on peduncles several times longer than the petioles. *Flowers* 6-8 in a compound umbel; pedicels bracteolate at the base, slender,

twice as long as the flowers. *Calyx-tube* cup-shaped, the fundus broad, slightly constricted below the thick, short, undulate, broadly 4-toothed limb. *Petals* conical in bud. *Fruit* globular, somewhat depressed, smooth, crowned by the narrow calyx-limb, .25 in. in diam. Triana in Trans. Linn. Soc. XXVIII, 158; DC. Prodr. III, 6; Clarke in Hook. fil. Fl. Br. Ind. II, 562; Cogn. in DC. Mon. Phan. VII, 1152 (excl. var. *flavescens*).

MALACCA; *Griffith* (Kew Distrib.) 2325; *Maingay* 810; *Derry* 1041; *Ridley* 3297, 3298, 4574. JOHORE; *Ridley* 4656. PERAK; *King's Collector* 3458, 6754.

25. *MEMECYLON GARCINOIDES*, Blume, Mus. Bot. I, 358 (excl. var. B). A tree, 20-40 feet high; young branches terete, slender, pale-brown. *Leaves* thinly coriaceous, oblong-ovate or elliptic, abruptly and rather obtusely acuminate, the base cuneate, drying pale-brown tinged with olive, the under surface the palest; main nerves invisible; length 3-5.5 in., breadth 1-2 in.; petiole .05-1 in. *Cymes* axillary and in the axils of old leaves, umbellate, many-flowered, on short peduncles (.2 in. long, longer in fruit); pedicels slender, bracteolate at the base, .1-.15 in. long. Flower-buds acute. *Calyx-tube* small and cup-shaped, the mouth very wide (nearly .1 in.), truncate, but with four minute, acute teeth. *Fruit* globular, smooth, pale when dry, .2 in. in diam. Cogn. in DC. Mon. Phan. VII, 1152.

MALACCA; *Derry* 1240. *Maingay* (Kew Distrib.) 817. PERAK; *Scortechini* 2033; *Wray* 2961, 3208; *King's Collector* 1984, 2938, 7123, 10034; SINGAPORE; *Ridley* 8118. SELANGORE; *Ridley* 7333. DISTRIB. Sumatra, Blume, *Forbes* 2970, 3108; Borneo, *Beccari* 536.

26. *MEMECYLON ANDAMANICUM*, King, n. sp. A shrub; young branches slender with faint grooves below the nodes, the bark pale-brown. *Leaves* chartaceous, brown on the upper and greenish-yellow on the lower surface when dry, oblong-lanceolate, gradually and bluntly acuminate, the base cuneate; main nerves 10-12 pairs, interarching near the edge, sub-horizontal; length 2.25-3 in.; breadth .75-1 in.; petiole .25-.3 in. *Peduncles* unequal, .2-.4 in. long, in pairs in the axils of leaves or of fallen leaves, bearing at their apices several 3-5-flowered umbels, bracteolate at the divisions, flower-pedicels as long as the calyx, minutely bracteolate at the base. *Calyx-tube* campanulate, tapered below, the mouth truncate, nearly .2 in. wide. Bud of petals conical. *Fruit* depressed-globular, crowned by the small calyx-limb, yellowish, .2 in. in diam.

ANDAMAN ISLANDS; *King's Collectors*, 357, 452. NICOBAR ISLANDS.

A species with leaves somewhat like those of *M. garcinoides*, Bl., but narrower. In its inflorescence it resembles *M. acuminatum*, Sm., but the peduncles are longer

than in that species. The inflorescence also resembles that of *M. intermedium*, Bl., but when young it is covered with a yellow waxy coat; the pedicels and peduncles are moreover much shorter than in *M. intermedium*. The leaves resemble those of the latter species in shape but are of a thinner texture so that the nerves are visible though faint.

27. *MEMECYLON INTERMEDIUM*, Blume, Mus. Bot. I, 358. A tree, 20–40 feet high; young branches slender, terete, pale cinereous. *Leaves* thinly coriaceous, broadly ovate, shortly and bluntly acuminate, the base cuneate, greenish above and brown beneath when dry; main nerves invisible or nearly so; length 2·75–3·5 in.; breadth 1·25–2 in.; petiole ·25–·35 in. *Cymes* large, crowded, in the axils of leaves or of fallen leaves, usually in pairs, on peduncles several times longer than the petioles, compoundly umbellate; pedicels slender, bracteolate at the base, ·1 in. long. *Calyx-tube* cup-shaped, with a wide, truncate, edentate or minutely toothed limb. *Fruit* not seen (globose *vide* Cogniaux). Triana in Linn. Trans. XXVIII, 157; C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 561; Cogn. in DC. Mon. Phan. VII, 1158. *M. umbellatum*, Blume, Bijdr. 1094 (not of Burm.) Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 273; Miq. Fl. Ind. Bat. I, pt. I, 575. *M. garcinioides*, Bl., var. *elongatum*, Blume, Mus. Bot. I, 358.

PERAK; *Scortechini* 1036. DISTRIB. Sumatra; Java.

This resembles *M. garcinioides*, Bl., very closely, but differs in inflorescence, the cymes of this being larger, on longer peduncles.

28. *MEMECYLON EDULE*, Roxb., Corom. Plants I, t. 82. A shrub or small tree; young branches terete, pale when dry. *Leaves* coriaceous, drying brown, the lower surface paler, both often with an olivaceous tinge, elliptic or ovate, the apex sub-acute or shortly and bluntly acuminate, the base usually cuneate but sometimes rounded; main nerves 5–8 pairs, very inconspicuous, ascending; length 2–4 in.; breadth ·85–2·25 in.; petiole ·1–·35 in. *Peduncles* several together, unequal in length, longer than the petioles, axillary, umbellately cymose, many-flowered; pedicels longer than the calyx. *Calyx-tube* cupular, narrowed to the base, the limb truncate, sometimes obscurely 4-toothed. *Fruit* globular, crowned by the small calyx-limb, ·25 in. in diam.

Only two of the numerous varieties of this species occur in our region. These are as follows:—

VAR. 1. *typica*. Leaves usually under 3 in. long, dull, tinged with yellow when dry, acute or obtuse. *M. edule*, Roxb. Fl. Ind. II, 260; DC. Prodr. III, 6; Wall. Cat. 4107; Dalz. & Gibs. Bomb. Fl. 93; Kurz, For. Fl. I, 512. *M. edule*, var. *α*, Thwaites Enum. 111. *M. umbellatum*, Burm. Fl. Zeyl. t. 31. *M. tinctorium*, Koen. ex W. & A. Prodr. 319; Wight Ill. t. 31. *M. globiferum*, Wall. Cat. 4108. *M. pyriformium*, Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 277.

SINGAPORE; *Ridley* 4084, 6054. MALACCA; *Griffith* (Kew Distrib.) 2327; *Maingay* (K.D.) 812; *Derry* 1028. KEDAH; *Ridley* 2627, *Curtis* 2627. DISTRIB. India, Ceylon.

VAR. 2. *ovata*, C. B. Clarke in Hook. fil. Fl. Br. Ind. II, 563. Leaves large, often 4-4.5 in. long, acute or acuminate at the apex, the base rounded or cuneate, shining when dry; fruit black when ripe and somewhat succulent. *M. ovatum*, Sm. ex Kurz, For. Fl. I, 512. *M. edule*, VAR.  $\gamma$ , Thwaites Enum. 110. *M. umbellatum*, Hb. Heyne in Wall. Cat. 4109. *M. tinctorium*, VAR.  $\beta$ , W. & A. Prodr. 319. *M. prasinum*, Naud. in Ann. Sc. Nat. Ser. 3, XVIII, 275. *M. grande*, Wall. Cat. 4103, partly. *M. lucidum* and *M. pyriformis*, Presl. Epim. Bot. 209, 210.

ANDAMAN ISLANDS; not common. NARCONDAM and GREAT COCO ISLANDS; *Prain*. PERAK; *King's Collector* 4175; *Scortechini* 947. PENANG; *Curtis* 723. SINGAPORE; *Ridley* 6532. DISTRIB. India, Malayan Archipelago.

DOUBTFUL SPECIES.

*M. amabile*, Bedd. VAR. *malaccensis*, Clarke in Fl. Br. Ind. II, 555. This is founded by its author on the very imperfect material afforded by *Maingay's* specimens (Kew Distrib. 819).

*M. laxiflorum*, Wall. Cat.; see note under *M. oleaeifolium*, Blume.





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Malayan Peninsula, new species of Melastomaceæ.

BOTANY.

M.

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Melastomaceæ, new, from Malayan Peninsula:—

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[See also King, separate slip.]

Malayan Peninsula, new species of Melastomaceæ.





# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



Vol. LXIX. Part II.—NATURAL SCIENCE.

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No. II.—1900.

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II.—*Note on four Mammals from the neighbourhood of Darjeeling.*—By  
W. P. MASSON. *Communicated by the Natural History Secretary.*

[Received 14th January; Read 4th April, 1900.]

Mr. G. C. Dudgeon, F.E.S., having recently published in the Proceedings of the Asiatic Society of Bengal, p. 111 (1899), a paper entitled “Mammalia not hitherto recorded from the Darjeeling District and Sikkim,” I venture to lay my experience gained by having collected largely during a period of nearly twenty years in that region before the members of the Society, as regards the animals referred to by Mr. Dudgeon.

*Ursus malayanus*, Raffles. With regard to this animal in the year 1883 I wrote to “*The Field*” under the nom-de-plume of “Pulteney” a note entitled “Bear Shooting in Darjeeling”:—“Jerdon, in his ‘Mammalia of India’—and I see Mr. Sterndale follows him—has only one species of black bear found on the Himalayas (*Ursus tibetanus*).”<sup>\*</sup> Now I know two distinct kinds, *U. tibetanus* and a smaller species. *U. tibetanus* seldom climbs trees, but the smaller species always does.

\* Mr. W. T. Blanford in ‘The Fauna of British India—Mammalia,’ p. 197, n. 93, uses the name *U. torquatus*, Wagner, for this species in preference to *U. tibetanus*, Cuvier, the older name, for the reason that this bear is not found in Tibet itself, and is therefore misleading. [*Ed.*]

It is entirely a very glossy black, with the exception of a very narrow white mark on the chest, sending up a branch on each side in front of the shoulder; the nose is buff-coloured or white. I have shot many of both species, and have now in my possession skins of both. Most of the villagers about the hills could have told Mr. Sterndale that there were two kinds of bears, one called 'bhooe bhaloo,' or ground bear, and another 'rook bhaloo,' or tree bear. I have always found the bhooe bhaloo or ground bear (*Ursus tibetanus*) very much more numerous than the rook bhaloo or tree bear." In the same note I mentioned that on the 23rd of October, 1883, a friend, my brother and myself went to Birch Hill Park about 9 p.m. one moonlight night, and we saw three bears in a small oak eating the acorns; and on the following night counted no less than five in a single tree, all of them were rook bhaloos. These numbers are unusual, as a rule not more than a couple of bears are seen in one tree. I may remark that I have since found that *U. tibetanus* in the Darjeeling District does climb trees, as I have shot them in oaks when the acorns are ripe in October. Also that the smaller species, *U. malayanus*, principally affects oaks and chestnuts, in which they form rude nests by breaking off the smaller branches and piling them into a heap amongst the larger branches; and that the examples of *U. malayanus* I have shot were of the normal form described by Mr. Blanford in which the crescentic white patch on the chest does not have the apex prolonged into a white streak on the abdomen. The claws are short. The hillmen dread the rook bhaloo very much more than the larger species, and they all agree that if disturbed it attacks at once.

*Atherura macrura*, Linnæus. I have had the Asiatic Brush-tailed Porcupine from below Ging, from near the Rumam river, and from the Rohitak Valley—all in Sikhim. One of my collectors brought me a fine specimen of the species from beyond Sandukpho on the Nepalese frontier, over 11,000 feet elevation.

*Nemorhætus bubalina*, Hodgson. I have shot the Himalayan Goat-antelope or Serow on some rocky steep hills close to Sandukpho at about 11,000 feet elevation, have seen them shot at Senchal at about 8,000 feet, have again got them on some rocky steep ground below Soom and Singtom at about 4,000 feet, and again on some very rocky ground on the Sikhim side of the Rumam river at about the same elevation.

*Cemas goral*, Hardwicke. I have shot the Goral near Philot and near Tongloo, at about 12,000 feet elevation, again on the landslip between Soom and Singtom, and numbers are to be found on some very rocky and precipitous ground on the banks of the Rumam River.

III.—*On a new method of treating the properties of the circle and analogous matters.*—By PROMOTHONATH DUTT, M.A., B.L. Communicated by the Natural History Secretary.

[Received 13th March; Read 4th April, 1900.]

According to Euclid the circle is defined as a plane figure, which is such that the length of any straight line drawn from a certain point within the circle to the boundary is constant.

A circle may also be defined as the locus of a point which moves so that the ratio of its distances from two fixed points is constant. This proposition has been proved as prop. 4 of the Theorems and Examples on Bk. VI in Hall and Stevens's edition of Euclid, page 361. There the proposition has been given in the following words: "Given the base of a triangle and the ratio of the other two sides, to find the locus of the vertex." The proof shows that the locus is a circle. I propose to take this property of the circle as my starting point, and to deduce other properties from it. I shall first of all proceed to show how the centre of the circle can be found from the definition adopted.

Let  $A, B$  be two given points, and  $PDE$  be the circle, so that whatever the position of  $P$ , the ratio of  $AP$  to  $BP$  is constant.

$$\text{Then } \frac{AP}{BP} = \frac{AD}{BD}$$

$\therefore \angle APD = \angle BPD$  (prop. 3, Euc. Bk. VI).

$$\text{Also } \frac{AP}{BP} = \frac{AE}{BE}$$

$\therefore \angle BPE = \angle QPE$  (prop. A. Euc. Bk. VI).

$\therefore \angle EPD$  is a right angle.

Take  $C$  as the middle point of  $DE$ .

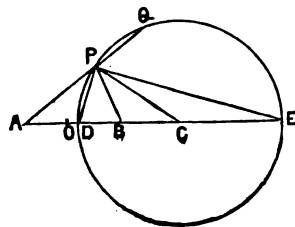
By a well-known rider (Ex. 2, on prop. 32, Bk. I, Hall and Stevens page 100).

We have  $CP = CD = CE$ .

$\therefore C$  is the centre of the circle.

According to the definition adopted, it will be found that  $AB$  is divided harmonically at  $D$  and  $E$  (Hall and Stevens's Geometry, Example I, Bk. VI, page 360). It will appear from Example III, that the straight line through  $B$  drawn at right-angles to the diameter  $DE$  is the polar of  $A$  with respect to the circle. Example II shows that if  $O$  be the middle point of  $AB$ ,  $OD.OE = OB^2$ . Example I at page 233 (Hall and Stevens) shows that the rectangle  $AC, BC$  is equal to the square on the radius.

Fig. 1.



Let us write the property in the form  $r_1 = mr_2$ , where  $r_1 = AP$ ,  $r_2 = BP$ . Describe two circles with the fixed points as centres, and radii equal to  $a, b$  so that  $a = mb$ , then the equation of the circle can be reduced to the form  $r_1 - a = m(r_2 - b)$ , which means geometrically that the distance of any point on the circle  $r_1 = mr_2$  from the circumferences of the circles described with the fixed points as centres are in the fixed ratio  $m$ . (1).

The form  $r_1 - a = m(r_2 - b)$  shows that the circle passes through the intersections of  $r_1 = a$ , and  $r_2 = b$ , and it is evident, therefore, that the three circles  $r_1 = a$ ,  $r_2 = b$ , and  $r_1 = mr_2$  will co-intersect if  $a = mb$ .

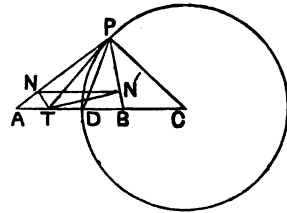
The proposition may be enunciated geometrically as follows:—

Let circles be described with the fixed points as centres, so that their radii are in the ratio  $m$ . The circle which represents the locus  $r_1 = mr_2$  passes through the intersections of these circles. (2).

If  $PT$  be the tangent at  $P$  we

Fig. 2.

$$\begin{aligned} \text{have } \frac{\cos APT}{\cos BPT} &= \frac{\frac{dr_1}{ds}}{\frac{dr_2}{ds}} \\ &= \frac{dr_1}{dr_2} \\ &= m. \end{aligned}$$



This property can also be deduced without the use of the differential calculus.  $CP$  is the normal at  $P$ .

$$\therefore \text{ we have } \frac{\sin CPA}{\sin CPB} = \frac{\cos APT}{\cos BPT}$$

$$\text{But } \frac{\sin CPA}{\sin CPB} = \frac{\frac{\sin CPA}{\sin PCA} \cdot \frac{CA}{AP}}{\frac{\sin CPB}{\sin PCB} \cdot \frac{CB}{BP}}$$

But from similar triangles we can prove that  $\frac{CA}{CB} = m^2$  (vide the figure of prop. 3, Hall and Stevens, page 361).

$$\text{Also } \frac{AP}{BP} = m$$

$$\therefore \frac{\cos APT}{\cos BPT} = m. \quad (3).$$

Let  $N, N'$  be the feet of the perpendiculars from  $T$  on  $AP$  and  $BP$ . Then  $PN = PT \cos APT$ ,  $PN' = PT \cos BPT$ .

$$\therefore PN = m \cdot PN'.$$

$$\text{Also } AP = m \cdot BP.$$

$$\therefore AN = m \cdot BN'.$$

But the circle described on  $AT$  as diameter cuts  $AP$  at  $N$  and that on  $BT$  cuts  $BP$  at  $N'$ .

The proposition may be enunciated geometrically thus:—

If the tangent at any point  $P$  to a circle meets the line joining the fixed points  $A, B$  in  $T$  and on  $AT, BT$  are described circles cutting  $AP, BP$  in  $N, N'$  respectively, then the ratio of  $AN$  to  $BN'$  is the same as that of  $AP$  to  $BP$ . (4).

As an alternative and purely geometrical proof of prop. (4) the following is given.\*

Join  $NN'$  and  $PD$ .

We have  $\angle CPB = \angle CPD - \angle BPD = \angle CDP - \angle APD = \angle PAD$ .

$\therefore \angle ATN$  being the complement of  $\angle PAD$  is equal to  $\angle BPT$ , the complement of  $\angle CPB$ .

But  $P, N, T, N'$  lie on a circle.

$$\therefore \angle N'PT = \angle TNN'$$

$$\therefore \angle ATN = \angle TNN'$$

$\therefore AB$  is parallel to  $NN'$ .

$$\therefore \frac{AN}{BN'} = \frac{AP}{BP}$$

Let the circle described on  $AB$  as diameter cut the given circle in  $P$ . Then if  $O$  be the middle point of  $AB$ , we have  $OD.OE = OB^2 = OP^2$ .

$$\begin{aligned} \text{But } OD.OE &= CO^2 - CD^2 \\ &= CO^2 - CP^2. \end{aligned}$$

$$\therefore CO^2 = CP^2 + OP^2.$$

By Euclid I, 48,  $\angle OPC$  is a right-angle.

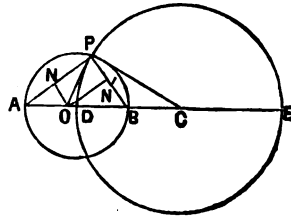
Therefore,  $OP$  is the tangent at  $P$  to the given circle, and it is the normal to the circle described on  $AB$  as diameter. Therefore, the circle described on the line joining the fixed points as diameter cuts the given circle at right angles. (5).

Also as proved before,  $PN = m. PN'$ .

$\therefore ON' = m. ON$  as  $PNON'$  is a rectangle.

Therefore, if the circle described on the line joining the fixed points cuts the given circle at  $P$ , and  $O$  be the point, where the tangent at  $P$  meets  $AB$ , then the distances of  $AP, BP$  from  $O$  are in their inverse ratio. (6).

Fig. 3.



\* For this proof I am indebted to my nephew, Babu Benodebihari Dutt of the Sanskrit College, who has given me much assistance in the composition of this paper. P.D.

The property follows also from the consideration of the equality of the areas of the triangles  $APQ$  and  $BPO$ .

Let  $AP$  cut the circle again in  $P'$ , then

$$\frac{AP}{BP} = \frac{AP'}{BP'}$$

$$\therefore \frac{AP}{AP'} = \frac{BP}{BP'}$$

$$\text{or } \frac{AP}{PP'} = \frac{BP}{BP' - BP} = \frac{BP}{P'Q} \text{ where } BQ = BP.$$

$\therefore PQ$  is  $\parallel AB$ . (7).

Let  $PB$  produced meet the circle in  $R$

$$\text{then } \frac{AP}{PB} = \frac{AR}{BR}$$

$$\therefore \frac{AP}{AR} = \frac{BP}{BR}$$

$$\therefore \angle PAB = \angle BAR. \quad (8).$$

Similarly it can be shewn that if  $P'B$  meet the circle in  $R'$  then

$$\angle P'AB = \angle BAR'.$$

$\therefore A, R', R$  lie on the same straight line. (9).

Again, in the two triangles  $APB, AR'B$  we have  $\angle PAB = \angle R'AB$  also  $\angle APB = \pi - \angle P'PR = \pi - \angle P'R'R = \angle AR'B$ , and the side  $AB$  is common

$\therefore$  we have  $BP = BR', AP = AR'$ .

Similarly we can show that  $BP' = BR$  and  $AP' = AR$ . (10).

Also  $BQ = BP$ .

$\therefore BP'^2 - BR'^2 = P'R' \cdot P'Q$ . (11).

Since  $BP = BQ = BR'$  we can show that the angle  $QPR'$  is a right-angle. (12).

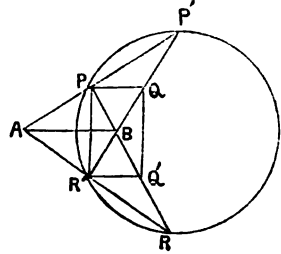
If  $R'Q'$  be drawn parallel to  $AB$ , similarly  $\angle QQ'R'$  is a right-angle, and as  $PQ, R'Q'$  are each parallel to  $AB$ ,  $QPR'Q'$  is a rectangle. (13).

And it is evident that  $P, Q, Q', R'$  lie on a circle, the centre of which is  $B$ . (14).

The results of propositions (7) to (14) may be summed up as follows:—

If a straight line be drawn through the fixed point  $A$ , cutting the circle in  $P$  and  $P'$  and  $PB, P'B$  meet the circle again in  $R$  and  $R'$ , and  $PQ$  and  $R'Q'$  are drawn parallel to  $AB$ , then  $A, R', R$  lie on one straight line. A circle with centre  $B$  passes through  $P, Q, Q', R'$ .  $AB$  bisects the angle  $P'AR'$  and  $P, R'$  and  $P', R$  are respectively symmetrical with respect to  $AB$ .

Fig. 4.



Now, let us consider the properties of the system of circles, obtained with the same fixed points  $A, B$ , by varying the ratio of  $AP$  to  $BP$ . We have  $\frac{CA}{CB} = m^2$ .

$$\therefore \frac{AB}{CB} = m^2 - 1 \text{ or } CB = \frac{AB}{m^2 - 1}.$$

Now,  $AB$  is constant  $\therefore CB \propto \frac{1}{m^2 - 1}$ . (15).

If  $m=1$ ,  $CB = \infty$ , and this must be so as in this case, the locus reduces itself to a straight line, which may be taken as the case of a circle with an infinite radius.

It will appear from (5) that all the circles of the system are intersected orthogonally by the circle described on  $AB$  as diameter.

If  $r$  be the radius of the circle,  $r^2 = CA \times CB = m^2 \times \left(\frac{AB}{m^2 - 1}\right)^2$ .

$$\therefore r = AB \times \frac{m}{m^2 - 1}.$$

$$\text{or } AB = r \left(m - \frac{1}{m}\right). \quad (16).$$

This shows that the radius remains the same if  $m$  be changed into  $-\frac{1}{m}$ .

Geometrically this means that if we describe a circle making  $BP = m \cdot AP$ , the radius will be the same, but the centre will be on the other side, and this also appears from the consideration of symmetry.

The relation  $r_1 = mr_2$  reduces to  $r = ma$  where  $a$  is fixed, and  $r$  and  $m$  vary. Writing the relation in the form  $\frac{r}{m} = a$ , we arrive at another result, which may be enunciated as follows:—

If two circles be described, one on the line joining the fixed points as diameter, and the other with centre  $B$  and radius equal to  $a$ ; then if any of the system of circles drawn with the same fixed points  $A, B$  and having the relation  $r_1 = mr_2$  cut the circle described round  $B$  as centre in  $P$ , and the straight line  $AB$  in  $D$ , and  $DE$  be drawn perpendicular to  $AB$ , meeting the circle described on  $AB$  as diameter in  $E$ , then the length of  $AP$  varies as the square of the co-tangent of the angle  $DAE$ .

$$\begin{aligned}
 \text{We have } AP &= BP \times \frac{AD}{BD} \\
 &= BP \times \frac{AD}{DE} \times \frac{DE}{BD} \\
 &= BP \cot^2 DAE \\
 &= a \cot^2 DAE.
 \end{aligned}$$

Therefore, the position of the point  $P$  is known if the magnitude of the angle  $BAE$  is given.

Also for any point on the circle described round  $B$  with a fixed radius  $AP$   $\tan^2 BAE$  is constant and equal to the radius. (17).

Now, if  $AP$ ,  $BP$  vary but the ratio  $\frac{AP}{BP}$  remains constant, the ratio

$\frac{AD}{BD}$  will remain constant, and also the angle  $BAE$ .

Therefore, if  $A$  be fixed and any point  $B$  is taken in  $AB$ , and  $D$  taken such that  $\frac{AD}{BD}$  is constant, the locus of the point where the perpendicular at  $D$  meets the circle described on  $AB$  as diameter is a fixed straight line through  $A$ . (18).

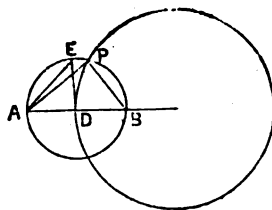
The preceding propositions will, I hope, show the utility of the method. Many other properties may be similarly deduced, and this paper is put forward in the hope that it will lead to the deduction of other important and useful results by others.

I beg to add that the properties alluded to before, may, I think, be utilised in some physical experiments in which two motions are produced simultaneously at two different places, but as I have not the opportunity or ability to carry them out myself, I only beg to give a brief outline of the method in the hope that others will be able to work it out.

*Experimental measurement of the velocity of sound from observations in a railway train.*—If a railway train travels at a constant speed, and a sound be produced at a distance at the same moment, when the train leaves the station, the sound will be heard in the train at only two points in the line of motion, formed by its intersection with the circle with the source of sound and the station as the fixed points. From the observations the ratio of the velocity of sound to that of the railway train can be calculated, as shewn below. The following proof applies to the case in which the line of motion is at right-angles to the line joining the railway station to the source of sound.

Let  $B$  be the station and  $A$  the source of sound in the figure in Ex. 3, Hall and Stevens page 361, and let  $H$  and  $K$  be the points where

Fig. 5.





the sound from *A* is heard. Then, from the observation of the time since leaving the station, an observer can find the distance *BH*, if the speed of the railway train be known. *AB* can be found by direct measurement, and thence *AH*. The ratio of *AH* to *BH* gives that of the velocity of the sound to that of the train.

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IV.—*Note on a method of detecting free Phosphorus.*—By P. MUKERJI, B.Sc., Professor of Chemistry, Presidency College, Calcutta. Communicated by the Natural History Secretary.

[Received 12th March; Read 4th April, 1900.]

The following statement is made in Roscoe's Treatise on Chemistry and in Watts' Dictionary of Chemistry: Phosphorus does not directly combine with Hydrogen.

The principle employed for the detection of free Phosphorus in the present note is the phosphorescence of the vapour of Phosphorus diluted with Hydrogen gas.

The following is the *apparatus* employed: A three-necked Woulffe's bottle; to the middle neck of which there is attached by a cork a tube about eleven inches long and of half an inch diameter, the upper end of the tube being closed with a cork. To another neck a safety funnel with a long tube is attached, and in the third neck a short jet is inserted. The tube of the safety funnel dips into the liquid in the bottle; the middle tube and the jet enter the bottle only for a short distance. The tube attached to the middle neck is somewhat *loosely* fitted so that traces of air may enter the bottle. The jet and the funnel are fitted tightly. The capacity of the bottle may be a litre or less.

For the above-mentioned apparatus a simpler one has been substituted in several experiments; namely, a small flask of about 184 c.c. capacity, and fitted with a funnel with a stopcock and also with a jet.

*The method of carrying out the test, and the appearance:*—Zinc and dilute Sulphuric acid are introduced into the bottle, and the gas issuing from the jet is observed. If in a *dark* room, there is no glow perceived, then the materials employed are free from uncombined Phosphorus. When the bottle is so hot through the chemical action between the zinc and acid that it can scarcely be touched, *i.e.*, when the temperature of the liquid is about 60° to 70° C., and that of the gas in the upper part of the bottle is 45° to 50° C., the cork is removed from the top of the tube attached to the middle neck and the substance suspected to be

Phosphorus or to contain this in a free state is introduced through the tube into the bottle, and then the cork is quickly inserted. If an organic mixture suspected to contain free Phosphorus has to be introduced, it may be poured in through the thistle funnel, or better still through the neck to which the jet is attached; the jet is quickly put back into the neck after introduction of the mixture. Soon after the introduction of Phosphorus (free) the gas issuing from the jet is found to glow in a dark room, a sheaf of light emanating from the jet. The liquid inside the bottle glows, and luminous flashes are also seen now and then. If now the cork at the top of the middle tube be removed, the light will sink down through the jet, and the gas escaping at the top of the middle tube will glow. On replacing the cork the glow will reappear at the jet. By alternately removing and replacing this cork, the glow may be made to move downwards and upwards through the jet at the option of the operator. [If the second form of apparatus is used, it is only necessary to take off and replace the stopcock below the funnel, and the glow will appear alternately in the funnel and at the jet.]

Fresh quantities of dilute Sulphuric acid and Platinic chloride may be introduced if the glow shews sign of ceasing.

*Delicacy of the test*:—In one experiment, 7 mgrs. of Phosphorus were cut into two larger and two smaller pieces; and one of the smaller pieces (about 1.5 mgr.) was introduced into the second form of apparatus; the appearance noted above was observed. After about half an hour the zinc was washed two or three times and kept in the flask under water. About twenty-four hours later this zinc without any further addition of Phosphorus again shewed the glow at the jet and in the funnel.

In another experiment the first form of apparatus was employed, the capacity of the bottle being a little over a litre. 112 grammes of zinc, 250 c.c. of acid and water, and 30 c.c. of milk were introduced into the bottle; next 2 mgr. of Phosphorus were introduced. The jet, the middle tube, and the bottle all glowed in the way described above. It may be here stated that Fresenius's limit for Mitscherlich's test is 1.5 mgr. of Phosphorus in 150 grammes of mixture; the second experiment shews that the present method is at least as delicate as Mitscherlich's.

*Remarks on the process*:—The use of nascent Hydrogen as a reagent for the detection of Phosphorus is not new. Valentine mentions it in his Qualitative Analysis; but his method is not the same as the present method. He observes the green core of the hydrogen jet after ignition, and he does not use a dark room. Moreover, his apparatus is Marsh's Apparatus. His test is not a test of free Phosphorus only but indicates

indifferently either Phosphorus, phosphide, phosphite or hypophosphite, since any one of these substances will give a *flame* with a green core on treatment with nascent hydrogen, *i.e.*, with zinc and dilute Sulphuric acid. It need hardly be stated that the method described in this paper is not the Blondlot-Dussard Method, since the Hydrogen jet is *not* ignited, and the appearance observed is not the green core of the flame of *burning* Hydrogen. The phenomena observed in the present method are very similar to those described by Crookes in page 489 of his *Select Methods*, Third Edition. Crookes, however, uses a somewhat complicated distilling and condensing apparatus, and employs a lamp for distilling the Phosphorus: the lamp again necessitates the use of materials for preventing its light from hindering the observation of the glow. Moreover, in his method, the glow is *not under control*. The apparatus described above is simple; no lamp is required for heating, and consequently no precaution is necessary, as to the reflected light of the lamp being mistaken for the glow of Phosphorus. Again, the operator can by using the present method make the glow move up and down as often as he likes and with great ease. Finally, there is no risk of explosion, since hydrogen *continues* to be evolved even when air is sucked in through the jet (by opening the top of the middle tube); air cannot rush in to any large extent. Lastly, Phosphorus can not only be detected by this method, but it can also be estimated quantitatively by passing the vapour thus evolved into silver nitrate solution.

After determining the exact method in which the present test is to be carried out, the influence of a good many substances upon the glow described above was tried; and by comparing the results obtained with those stated in connection with Mitscherlich's method by Crookes and others it appears that the *present method is superior to Mitscherlich's*. This will be seen from what will be stated presently. It may be first of all noted that common bazaar zinc was used; the zinc contained some Phosphorus in the combined state (and also some Arsenic). Hence in contact with dilute Sulphuric acid the zinc evolved a jet of hydrogen, which burnt with a green core on ignition, but which gave no glow without introduction of free Phosphorus. It follows that for the *detection* of Phosphorus, it is not necessary to use pure zinc. It may be suggested that steam could be substituted for nascent Hydrogen in the second form of apparatus described above. The objection to steam is that the glow is not as controllable as it is with nascent Hydrogen; moreover there is the risk of explosion after suction of air through the jet by removing the lamp from below the flask and *then re-heating*. The risk of explosion will be distinctly greater in presence of mustard oil, phosphoretted hydrogen, &c., and in presence of Iodine, Sulphuretted

Hydrogen, Ether, &c. ; nascent Hydrogen has also a decisive superiority as will appear later on. Then again on *boiling* Phosphorus in a complex aqueous mixture (when the temperature must be higher than 100° C.) some portion of the element may get oxidised by water if by nothing else and cannot then be vaporised.

As already stated some of the substances in presence of which Phosphorus was detected by this method were such as are known to interfere with the glow in the older methods. Milk, boiled rice, flour, silica, though not included in this category were thus tried ; the glow was well observed both at the jet and at the top of the middle tube after addition of Phosphorus. Sodium or potassium hypophosphite solution freshly prepared and filtered from particles of Phosphorus gave no glow, though phosphoretted hydrogen was apparently evolved as the gas at the jet burnt with a green core upon ignition : the glow appeared soon after introduction of a minute piece of Phosphorus. Phosphoretted hydrogen therefore does not interfere with the glow in this method. Sodium phosphite also gave no glow though it evolved phosphoretted hydrogen. Nitrous fumes are said to stop the glow of phosphorus, but it was found that in this method nitrate or nitrate mixed with chloride did not prevent the glow. Mustard oil was tried : it did not interfere with the glow ; the jet became blocked by a whitish oily deposit after some time, but there was the usual glow in the funnel (of the second form of apparatus). The gas did not take fire and there was no explosion. Sulphuretted hydrogen and also Iodine are stated to interfere with or stop the glow of Phosphorus. In the present method the result obtained in presence of either of these substances may be regarded as satisfactory. In one experiment 10 c.c. of a saturated solution of Iodine in potassium Iodide were introduced in three portions ; the glow was seen as usual, and the issuing gas did not colour starch paper to any appreciable degree. In another experiment about four-and-a-half grammes of powdered ferrous sulphide were introduced in two portions, and about 3 mgr. of Phosphorus were used. The glow was observed at the jet and in the funnel : next the jet was changed and the new jet also gave the glow. Ether, alcohol, and oil of turpentine were also tried. Oil of turpentine stopped the glow altogether ; but it was found that so far as the present method is concerned, the failure may be easily remedied. A piece of Phosphorus, about 2 mgr., was introduced into boiled rice ; oil of turpentine, 2.5 c.c., was next added and then a little water, and the mixture shaken. Now the turpentine was removed by decantation after adding some water ; the mixture was next quickly washed (by decantation) with Alcohol and finally with water. The mixture probably still contained traces of turpentine oil ; but on intro-

duction into the hydrogen-evolving bottle, the glow was seen as usual. Next 5 c.c. of alcohol were introduced into the bottle, the glow continued at the jet, and was also observed at the middle tube, though it was a little less bright. As regards either it is as prejudicial to the glow as oil of turpentine: but there is this difference that the glow appears *after a time* on introduction of a fresh piece of Phosphorus.

It may be stated here that after the experiment is over, the bottle or flask used for the experiment should be filled with water before opening it in air.

It will be seen from what has been stated above that the present method will greatly facilitate the detection of Phosphorus in food and in cases of poisoning. The apparatus described is simple; and Zinc and Sulphuric acid can be procured in any town. The glow is seen on a magnified scale; and there is no possibility of its being mistaken, especially as no lamp is required. Moreover, many substances that hinder the glow of Phosphorus in the older methods do not affect the glow as observed by the present method.

I have lastly to state that my assistant, Haridas Saha, M.A., has helped me considerably in carrying out these experiments.

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V.—*Note on the occurrence of Rhodospiza obsoleta (Licht.) in the Tochi Valley.*—By CAPT. H. J. WALTON, I.M.S.

[Received 18th May; Read 6th June, 1900.]

Lieut. S. R. Douglas, I.M.S., has very kindly been collecting birds for me in the Tochi Valley for some months. Amongst some that I recently received from him, from Datta Khel, are two specimens of *Rhodospiza obsoleta* (Licht.).

Mr. Oates, in vol. ii, "Fauna of British India, Birds," p. 223, mentions this Desert Rose-Finch as a species likely to be found in India, but I can find no previous record of it having been procured within the limits of the empire.

There is no doubt about the identification; I have compared the birds with those in the Indian Museum, collected by Stoliczka in Turkestan, and Mr. Finn also agrees that they are *R. obsoleta*. As my two specimens are carbolised, I am not sure of the sexes: the one that I take to be the male is a larger bird than the other, and has the lores and a very narrow frontal line black, the upper tail-coverts contrast with the sandy-brown back in being rather bright rufous, the inner secondaries are rather broadly edged with pale buff.

The other bird, which I take to be the hen, has the lores buff, and the upper tail-coverts and inner secondaries concolorous with the sandy-brown back.

The first specimen was shot on April 14th, 1900. Its measurements, taken in the flesh, are:—

Long: tot: 6.45 inches.  
 al: 3.3     ,,  
 caud: 2.37     ,,  
 culm: 0.4     ,,  
 tars: 0.625     ,,

The smaller bird was shot on April 18th, 1900, and measures

Long: tot: 6.1 inches.  
 al: 3.25     ,,  
 caud: 2.25     ,,  
 culm: 0.43     ,,  
 tars: 0.625     ,,

The colours of the soft parts were not noted.

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VI.—*On the Birds collected and observed in the Southern Shan States of Upper Burma.*—By COL. C. T. BINGHAM, F.Z.S., and H. N. THOMPSON, F.Z.S. *Communicated by the Natural History Secretary.*

[Received 16th May; Read 6th June, 1900.]

The Southern Shan States may roughly be said to be bounded on the north by the Northern Shan States which are separated from them by the Nam Tu or Myitgnè river; on the east by Chinese territory and the French possessions on the Mèkong river; on the south-east and south by the Siamese Shan States, and the semi-independent state of Karreni; and on the west by the settled districts of Pinyinana, Kyauksè, and Meiktila.

A large portion of this territory consists of stretches of plateau land at elevations from 2500 to 5000 ft. above the level of the sea, but low-lying hot valleys and high ranges of hills with peaks rising to 8000 ft. and upward also occur. The flora and fauna of the States is consequently very diversified and well-worth thorough exploration and working out.

During last cold weather (1899-1900) accompanied by Mr. H. N. Thompson, Deputy Conservator in charge of the forests, Southern Shan

States, I made a short tour in some of the most western of the States. It was on this tour that the greater part of the material on which this paper is founded was collected, but many additions have been made by Mr. Thompson of birds collected or observed and identified by him previous to and after our joint tour. We were fortunate in being able to spend a few days at various camps on Loi-San-Pa, a mountain about 8000 ft. in elevation\* situated in the Mông Kông State. Here the birds procured were most interesting and I think fairly representative of the Avi-fauna of the country.

Altogether something over 350 specimens representing 239 species were obtained during the tour or subsequently by Mr. Thompson, while 62 species, specimens of which were not procured, were seen, noted and identified beyond a doubt.

In the list which follows, one or two of the birds entered under already described species, vary more or less in size and colouring from their types. These might possibly be separated as distinct. I have however while noting the points of difference preferred to consider them merely local races of well-known species found in the Himalayas, Assam, other parts of Burma, &c. Two species however, one procured at Kalaw 4300 ft., the other on Loi-San-Pa at 6000 ft. are in my opinion distinctly new. One of these is a pretty little Fly-catcher belonging to the genus *Cyornis*, the other a remarkable Bulbul allied in habits to *Hypsipetes*, but differing structurally and in colour from all species of that genus, and from all known Bubluls. I have ventured to propose (*vide* Annals and Magazine of Natural History, London, series vii, vol. v, No. 28 (April, 1900), pp. 357-359), a new genus *Cerasophila* for the aberrant Bulbul, and to name it *C. thompsoni* after Mr. Thompson, who was the first to shoot a specimen of the bird, recognizing it at the time as probably an undescribed species.

The arrangement followed in the subjoined list is that adopted in the volumes on the Birds, Fauna of India series, by Messrs. Oates and Blanford. An asterisk prefixed to the current number in the list shows that the species was seen and identified but not procured.

I have to express my thanks to Major A. Alcock, I.M.S., Superintendent of the Indian Museum, Calcutta, who was good enough to send a trained taxidermist to accompany my camp; and to Mr. Frank Finn, the Deputy Superintendent of the Museum, who kindly assisted me in comparing and identifying the birds obtained by me with the series of birds in the collection of the Indian Museum.

\* The actual heights on this mountain, which has a double cap, are Loi-San-Pa 8002 ft., Loi-Sang the northern rocky peak 8129 ft. above sea-level. (H.N.T.).

*Family* CORVIDÆ.

\*1 (4). *CORVUS MACRORHYNCHUS*, Wagler.

*Faun. Brit. Ind., Birds*, I, p. 17.

Very common throughout the more wooded portions of these States. Destroys and eats a large number of wild birds' eggs during the breeding season.

\*2 (8). *CORVUS INSOLENS*, Hume.

*Faun. Brit. Ind., Birds*, I, p. 21.

Common, but only in the villages and towns, not in the forest.

\*3 (10). *PICA RUSTICA*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 24.

Only once met with at Mông Lông (3000 ft.) in the Mông Kông State (C.T.B.). Common in the Eastern States of Hopong, Mông Pông, Môngnai, &c. I have met it close to the banks of the Mekong river, as low down as 1600 ft. Breeds in March and April. (H.N.T.).

4 (12). *UROCISSA OCCIPITALIS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 26.

Common in the drier parts of the States. One or two of the specimens procured had the lower plumage strongly tinged with a wash of ochreous-red.

5 (14). *CISSA CHINENSIS*, Bodd.

*Faun. Brit. Ind., Birds*, I, p. 28.

Decidedly rare. One specimen procured at Kalaw (4400 ft.).

6 (18). *DENDROCITTA HIMALAYENSIS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 32.

Common on the plateau in the north-west corner of the Yatsauk State, elevation 3600 ft. Has a pleasant metallic call. (H.N.T.).

7 (25). *GARRULUS LEUCOTIS*, Hume.

*Faun. Brit. Ind., Birds*, I, p. 39.

Very common in the States of Yatsauk and Mông Kông. Prefers dry oak forest and *Indaing*, and goes about in large parties. (H.N.T.).

Near Yatsauk I procured two out of a counted flock of over thirty. (C.T.B.).

Seems most plentiful at elevations of between 2500 and 3500 ft. One specimen was procured on Loi-San-Pa at 6000 ft.



\*8 (31). *PARUS ATRICEPS*, Horsf.*Faun. Brit. Ind., Birds*, I, p. 46.

Found along the western border of the States. (H.N.T.).

9 (32). *PARUS MINOR*, Temm.*Faun. Brit. Ind., Birds*, I, p. 48.

Procured wherever there were pine trees. Common at Kalaw 4400 ft., and on Loi-San-Pa up to 6000 ft. The green colour of the nape extends further down the back than in any Tenasserim specimens.

10 (41). *MACHLOLOPHUS SPILONOTUS*, Blyth.*Faun. Brit. Ind., Birds*, I, p. 54.

Loi-San-Pa 6000 ft. and upwards. Confined to dense evergreen forests.

11 (52). *PARADOXORNIS GUTTATICOLLIS*, A. David.*Faun. Brit. Ind., Birds*, I, p. 62.

I put up several individuals of this species when beating the forests for barking deer on the plateau in the north-west corner of the Yatsank State at an elevation of 3800 ft. I procured two specimens last April on the Salween-Mekong watershed at 6000 ft. (H.N.T.).

*Family CRATEROPODIDÆ.*12 (64). *DRYONASTES CHINENSIS*, Scop.*Faun. Brit. Ind., Birds*, I, p. 74.

One specimen on Loi-San-Pa 5000 ft. (C.T.B.). Common on the Mènètaung range on the west border of the Yatsank State. Is a very noisy bird. (H.N.T.).

13 (67). *DRYONASTES SANNIO*, Swinh.*Faun. Brit. Ind., Birds*, I, p. 76.

Common above 4000 ft.

14 (70). *GARRULAX BELANGERI*, Less.*Faun. Brit. Ind., Birds*, I, p. 79.

Procured along the road at various places. Does not seem to go higher than the edge of the Myèlat plateau at 3000 ft.

15 (72). *GARRULAX PECTORALIS*, Gould.*Faun. Brit. Ind., Birds*, I, p. 80.

Procured two specimens near Yatsank at 2800 ft. Noticed several

times in the low-lying hot valleys in the States. One of the specimens procured has the whole lower plumage washed with ochreous-yellow.

\*16 (73). *GARRULAX MONILIGER*, Hodg.

*Faun. Brit. Ind., Birds*, I, p. 81.

Noticed on one occasion mixed up in a flock of *G. pectoralis*.

17 (86). *TROCHALOPTERUM MELANOSTIGMA*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 92.

Loi-San-Pa between 5000 and 6000 ft. A great skulker.

18 (87). *TROCHALOPTERUM PHENICEUM*, Gould.

*Faun. Brit. Ind., Birds*, I, p. 93.

I procured specimens of this species on the Salween-Mekong watershed at 7000 ft. elevation. I observed it on one occasion on the slopes of Loi-San-Pa. (H.N.T.).

Specimens from Taunggyi differ, as noted below, from Mr. Blanford's description of this bird in *Faun. Brit. Ind., Birds* :—

No black supercilium; the head above and nape dark slatey-brown shading into olive-brown on the back, and paling to olive-green on the rump. The tail above is dark brown with conspicuous cross-barrings of dusky black; the outer three tail feathers on the underside suffused with crimson-brown and tipped broadly with pale orange; under tail coverts also tipped with orange. (C.T.B.).

19 (106). *ARGYA GULARIS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 107.

Confined to the hot low portions of the States.

20 (116). *POMATORHINUS SCHISTICEPS*, Hodg.

*Faun. Brit. Ind., Birds*, I, p. 116.

Common from 3000 ft. and upwards. Its loud "hoot-hoot-hoot" was one of the first sounds to greet one in the morning.

21 (129a). *POMATORHINUS IMBERBIS*, Salvadori.

*Faun. Brit. Ind., Birds*, IV, *App.*, p. 479.

At 4400 ft. Taunggyi, April and May. (H.N.T.) I have procured this species in the Ruby Mines District at 6000 ft. in April. (C.T.B.). Iris blood red. (H.N.T.).

22 (139). *PICTORHIS SINENSIS*, Gm.

*Faun. Brit. Ind., Birds*, I, p. 137.

Not uncommon, but a great skulker. One specimen procured near Taunggyi at 5000 ft.

23 (145). *PELLORNEUM SUBOCHRACEUM*, Swinh.

*Faun. Brit. Ind., Birds*, I, p. 142.

Common. Breeds in April (H.N.T.). I came across it only twice during the tour, and I entirely missed its incessant call of "pretty dear"—"pretty dear" so commonly heard in the Tenasserim forests. (C.T.B.).

24 (153). *CORYTHOGICHLA BREVICAUDATA*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 148.

Taunggyi, a single specimen. Hitherto I believe only procured on Moolayit mountain in Tenasserim.

25 (163). *ALCIPPE NEPALENSIS*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 157.

Confined to well-wooded parts. Procured near Taunggyi at 4000 ft.

26 (176). *MIXORNIS RUBRICAPILLUS*, Tick.

*Faun. Brit. Ind., Birds*, I, p. 167.

Near Taunggyi 4000 ft. Found occasionally in well-wooded parts, especially in bamboo jungle. Has a most monotonous call, which it keeps up throughout the day in the hot weather. (H.N.T.).

27 (182). *SITTIPARUS CASTANEICEPS*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 172.

One specimen procured on Loi-San-Pa at over 7000 ft. elevation. I have only seen this bird in dense evergreen forest at 7000 ft. and above. It sometimes clings to the stem of a tree like a Tree-Creeper (*Certhia*). (H.N.T.).

28 (188). *MYIOPHONEUS EUGENII*, Hume.

*Faun. Brit. Ind., Birds*, I, p. 179.

This species is in my opinion barely separable from *M. temminckii*. The points of difference noted by Oates are the absence of the white tipplings to the upper wing coverts, and the larger bill in *M. eugenii*. Two specimens were procured on the same stream on Loi-San-Pa at about 6000 ft., one has conspicuous white tips to the upper wing coverts, the other has not. Both however have large and massive bills. I have therefore considered them both as belonging to Hume's species

29 (203). *SIBIA PICAOIDES*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 195.

Loi-San-Pa about 6000 ft. I have only found this bird at high

elevations. It goes about in small flocks, and has a loud clear whistling call, which however is not kept up so long or so monotonously as that of *Lioptila melanoleuca*. It extends to the east to the Mekong-Salween watershed, a few miles west of the town of Kengtung. (H.N.T.).

30 (206). *LIOPTILA MELANOLEUCA*, (Tick.), Blyth.  
*Faun. Brit. Ind., Birds*, I, p. 198.

31 (207). *LIOPTILA CASTANOPTERA*, Salvadori.  
*Faun. Brit. Ind., Birds*, I, p. 199.

The distribution of these two species is rather remarkable. After leaving the station at Thazi on the Burma Railway and proceeding by road to Taunggyi and Fort Stedman, the large civil and military stations in the Southern Shan States, the first *Lioptila* met with is *L. castanoptera*, which is common and the only species of the genus I found at Kalaw 4400 ft. It no doubt extends along the range of hills bordering the western side of the Myealat plateau to Karenni, from whence it was first sent by Signor Fea. This species so far as my observations go does not extend to the east of Kalaw, as on the range of hills including Taunggyi and extending to the south to Fort Stedman and northwards towards the hills in the Möng Kōng State including Loi-San-Pa I only found *L. melanoleuca*. At the same time it has to be noted that Oates (*loc. cit.*) records having examined a specimen of *L. castanoptera* which was obtained at Fort Stedman,\* where during several days collecting I only saw and procured *L. melanoleuca*, and Mr. Thompson informs me that both species occur to the east on the Salween-Mekong watershed.

32 (208). *LIOPTILA ANNECTENS*, Blyth.  
*Faun. Brit. Ind., Birds*, I, p. 199.

Common on Loi-San-Pa at 6000 ft. and upwards. A restless bird, always on the move, whistling as it twines in and out among the twigs and leaves.

33 (212). *ACTINODURA RAMSAYI*, Wald.  
*Faun. Brit. Ind., Birds*, I, p. 202.

Loi-San-Pa 4000 to 7000 ft. A decidedly rare bird in these States. It has a weird cry, which it monotonously repeated for two or three hours at a time from the topmost branch of a tree. (H.N.T.).

\* Query. Was this specimen procured in the hills to the West of the Fort Stedman lake? If so the Kalaw hills run out in that direction.

34 (222). *SIVA SORDIDA*, Hume.

*Faun. Brit. Ind., Birds*, I, p. 210.

Loi-San-Pa 6000 ft. and upwards. Hunts about the twigs, leaves, and flowers like a tit.

35 (228). *ZOSTEROPS SIMPLEX*, Swinh.

*Faun. Brit. Ind., Birds*, I, p. 215.

Met with at Kalaw and throughout the States at elevations of 3000 ft. and above. It is somewhat remarkable that none of the allied species of *Zosterops* were seen.

36 (236). *CUTIA NEPALENSIS*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 222.

I observed this species once or twice on the slopes of Loi-San-Pa, but was unable to procure a specimen. I have shot it further to the east on the Salween-Mekong watershed at 6000 ft. in dense evergreen forest. (H.N.T.).

37 (238). *PTERUTHIUS ERALATUS*, Tick.

*Faun. Brit. Ind., Birds*, I, p. 225.

Loi-San-Pa 7000 ft. Found in heavily-wooded localities at elevations of 5000 ft. and upwards. Not common. Keeps to the tops of the high trees searching the leaves and moss-covered stems for insects. (H.N.T.).

38 (240). *PTERUTHIUS INTERMEDIUS*, Hume.

*Faun. Brit. Ind., Birds*, I, p. 227.

One ♀ procured on Loi-San-Pa at about 6000 ft.

39 (243). *ÆGITHINA TIPHIA*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 230.

Common in the low hot valleys up to an altitude of 3000 ft. (H.N.T.). Particularly plentiful at Siuhè, foot of Taunggyi 2900 ft.

40 (247). *CHLOROPSIS AURIFRONS*, Temm.

*Faun. Brit. Ind., Birds*, I, p. 234.

Fairly common everywhere in the States. One specimen was procured at 5000 ft. on Loi-San-Pa.

41 (249). *CHLOROPSIS HARDWICKII*, Jard. and Selby.

*Faun. Brit. Ind., Birds*, I, p. 236.

Found above 4000 ft., and very common on Loi-San-Pa, where numbers crowded the wild cherry trees which were in full bloom.

42 (255). *MELANOCHLORA SULTANEA*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 241.

Seems to be rare in the States. One ♂ shot out of a small party in thick forest on a stream in the Mōng Pōng State, elevation about 2500 ft.

43 (257). *MESIA ARGENTAUROS*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 244.

Loi-San-Pa at 6000 ft. and above in dense evergreen bushes.

44 (261). *PSAROGLOSSA SPILOPTERA*, Vigors.

*Faun. Brit. Ind., Birds*, I, p. 249.

Met with once, at Sinhè 2900 ft., where a small flock were busy searching the flowers on a group of trees of the *Butea frondosa*.

45 (270). *HYPSSIPETES CONCOLOR*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 261.

Very common in all the well-wooded localities at an elevation of 4000 ft. and upwards.

46 (270 *bis*). *CERASOPHILA THOMPSONI*, Bingham.

*Ann. & Mag. Nat. Hist., Lond.*, seventh series, vol. v (1900), p. 358.

Loi-San-Pa 6000 ft. Mr. Thompson was the first to procure a specimen of this remarkable Bulbul, close to our camp on some wild cherry trees which were at the time of our visit in full bloom. Subsequently watching by the same groups of trees we were able to secure more specimens. The trees were crowded with birds, *Lioptila melano-leuca*, *Chloropsis hardwickii*, *Arachnotheras*, and Sun-birds. Every now and then parties of *Hypsipetes concolor*, and with them parties of this species would alight, busily work over the cherry blossoms, sending them in a shower to the ground, and then fly off. *Cerasophila* was most conspicuous with its snow-white head, and in flight, voice, and habits closely resembled *Hypsipetes*.

A very dark-coloured race or species was seen by me in 1897 on the high range dividing the Trans-Salween State of Mōng-Tun from that of Mōng-Hsat. (H.N.T.).

It is very likely this dark-coloured bird will turn out to be *Hypsipetes leucocephalus*, Gmelin, a Chinese species. (C.T.B.).

47 (272). *HEMIXUS FLAVALA*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 263.

Loi-San-Pa up to 7000 ft. Not common.

48 (275). *HEMIXUS MACCLELLANDI*, Horsf.

*Faun. Brit. Ind., Birds*, I, p. 265.

Loi-San-Pa 5000 to 6000 ft. Fairly common, a very silent bird.

49 (277). *ALCURUS STRIATUS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 266.

Loi-San-Pa above 7000 ft., rare. The two specimens procured are remarkably large fine individuals with richer colouring and more yellow about them than Himalayan specimens.

50 (279). *MOLPASTES BURMANICUS*, Sharpe.

*Faun. Brit. Ind., Birds*, I, p. 269.

51 (280). *MOLPASTES NIGRIPILEUS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 270.

Both these species are fairly common in the States, the former affecting the low hot valleys and rarely ascending above 4000 ft.; the latter common round Taunggyi, at 4800 ft. and above. My belief is that the two species interbreed at Moulmein. I once found a nest in April, starting the female, an undoubted *M. nigripileus*, from it. She flew on to a tree close by and was joined by another Bulbul, which so far as I could make out had the breast much darker, like that of *M. burmanicus*. Both birds jerked about the tree in an excited manner, abusing me the while. On examining the nest I found the eggs were hard set, and marking the spot I withdrew. My intention was to let the eggs hatch out and then to take and rear the young birds, and see what species they turned out to be. Unfortunately I found two days later that the nest had been destroyed, probably by a cat, or squirrel.

In the Southern Shan States, specimens which seem intermediate between the two species were procured. In these the colour of the neck and throat is much darker than in true *M. nigripileus*, though not by any means so dark as in true *M. burmanicus*.

52 (287). *XANTHIXUS FLAVESCENS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 275.

Not uncommon in the well-wooded parts of the States.

53 (288). *OTOCOMPSA EMERIA*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 276.

Universally distributed.

54 (290). *OTOCOMPSA FLAVIVENTRIS*, Tick.

*Faun. Brit. Ind., Birds*, I, p. 278.

A very common bird in all the States. Much more of a jungle bird than the preceding species.

55 (292). *SPIZIXUS CANIFRONS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 280.

Loi-San-Pa 6000 ft. and upwards. Notwithstanding the peculiar shape of its head and bill, in habits and voice it is a true Bulbul. Procured also by Mr. Thompson on the Salween-Mèkong watershed at 7000 ft., and on the Mènètàng borders of Upper Burma at 6000 ft.

I also got specimens at Bernardmyo 7000 ft. (C.T.B.).

56 (296). *IOLÉ VIRESCENS*, Blyth?

*Faun. Brit. Ind., Birds*, I, p. 284.

Möng Köng and Yatsauk States at about 3000 ft. elevation. Two specimens procured answer, so far as plumage goes, fairly well to Oates' description (*loc. cit.*) and to Tenasserim specimens in the Indian Museum, but the Southern Shan States' bird seems conspicuously larger, and may hereafter be separated. Measurements taken in the flesh. Length 7·8'', Wing 3·7'', Tail 3·4'', Tarsus 0·7'', Bill from gape 0·6''. Bill horny-brown, lighter at the base of the lower mandible; legs and feet fleshy-brown; iris dark grey.

57 (297 *bis*). *PYCNONOTUS XANTHORRHOUS*, Anderson.

*Faun. Brit. Ind., Birds*, I, p. 286 (*foot note*).

Loi-San-Pa 6000 ft. I procured it also on the Salween-Mèkong watershed. (H.N.T.) It was not uncommon at Kyatpyin 4500 ft. in the Ruby Mines District, in April. (C.T.B.)

58 (306). *PYCNONOTUS BLANFORDI*, Jerdon.

*Faun. Brit. Ind., Birds*, I, p. 291.

Very rare in the States. One specimen procured just on the border below Wetpyuyè 2800 ft. Lower it is common. All the specimens procured had remarkably white ear-coverts.

#### *Family SITTIDÆ.*

59 (317). *SITTA NEGLECTA*, Wald.

*Faun. Brit. Ind., Birds*, I, p. 301.

The common Burmese Nuthatch was procured at elevations from 1000 to 3000 ft. Breeds in April in holes in the large banyan trees that are so common near the Shan villages.

60 (318). *SITTA NAGAENSIS*, Godw.-Aust.

*Faun. Brit. Ind., Birds*, I, p. 302.

Met with on several occasions above 3000 ft.



\*61 (319). *SITTA MAGNA*, Wardlaw Ramsay.

*Faun. Brit. Ind., Birds*, I, p. 308.

Exceedingly rare. I noticed this species both on Loi-San-Pa and at Taunggyi. From its size it cannot be confounded with any other Nuthatch. (H.N.T.) Two specimens, a ♂ and a ♀, sent me from Taunggyi by Mr. Thompson. The ♂ is similar in plumage to the ♀, but of a darker slaty-blue above, and conspicuously larger. Both ♂ and ♀ differ from the description in the Fauna volume in having the feathers of the head from the forehead to the nape lying between the two black bands that run from the nostril backwards, tipped with white. This speckled band is very conspicuous. (C.T.B.)

62 (325). *SITTA FRONTALIS*, Horsf.

*Faun. Brit. Ind., Birds*, I, p. 307.

Common in low hot valleys.

*Family DICURIDÆ.*

63 (327). *DICURUS ATER*, Hermann.

*Faun. Brit. Ind., Birds*, I, p. 312.

Occurs throughout the States. It was often observed, but only one specimen was shot at Thammakan 4300 ft.

64 (333). *DICURUS CINERACEUS*, Horsf.

*Faun. Brit. Ind., Birds*, I, p. 318.

This Drongo was fairly common, and was procured up to 6000 ft.

\*65 (334). *CHAPTIA AENEA*, Vieill.

*Faun. Brit. Ind., Birds*, I, p. 318.

Observed just below Kalaw at 3500 ft.

66 (335). *CHIBIA HOTTENTOTTA*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 320.

Common. (H.N.T.) One specimen procured on Loi-San-Pa at 6000 ft.

67 (339). *BHRINGA REMIFER*, Temm.

*Faun. Brit. Ind., Birds*, I, p. 324.

Rather uncommon. (H.N.T.). Several individuals were observed in heavy forest near Mōng Lōng at about 2000 ft. elevation. One was procured at Sinhè at about 3000 ft.

\*68 (340). *DISSEMURUS PARADISEUS*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 325.

Common in the well-wooded valleys at medium elevations. (H.N.T.)

*Family CETHIIDE.*

69 (344). *CERTHIA DISCOLOR*, Blyth

*Faun. Brit. Ind., Birds*, I, p. 331.

Loi-San-Pa 7000 ft. This appears to be rather rare in these States. I observed altogether about four individuals on the higher slopes of Loi-San-Pa, and have noticed it nowhere else. (H.N.T.)

*Family SYLVIIDE.*

70 (389). *MEGALURUS PALUSTRIS*, Horsf.

*Faun. Brit. Ind., Birds*, I, p. 383.

Procured at several places from 2000 ft. to 5000 ft. Common in the elephant-grass jungles near the larger streams. (H.N.T.)

71 (404). *HERBIVOCULA SCHWARZI*, Radde.

*Faun. Brit. Ind., Birds*, I, p. 399.

Loi-San-Pa 6000 ft. Taunggyi 5500 ft.

72 (405). *PHYLLOSCOPUS AFFINIS*, Tick.

*Faun. Brit. Ind., Birds*, I, p. 401.

Möng Löng at about 2000 ft. Not common.

73 (414). *PHYLLOSCOPUS PULCHER*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 407.

Loi-San-Pa 6000 to 7000 ft. Two specimens.

74 (417). *PHYLLOSCOPUS SUPERCILIOSUS*, Gmelin.

*Faun. Brit. Ind., Birds*, I, p. 409.

Very common during the cold weather. This bird was a perfect nuisance by its abundance, always getting shot in mistake for something else. It was procured up to 7000 ft. on Loi-San-Pa.

75 (423). *ACANTHOPNEUSTE PLUMBEITARSUS*, Swinh.

*Faun. Brit. Ind., Birds*, I, p. 414.

Loi-San-Pa 3000 ft. Rare. Specimens with and without the double bar on the wing (*A. viridiamus* ?) were shot.

76 (468). *PRINIA BLANDFORDI*, Wald.

*Faun. Brit. Ind., Birds*, I, p. 454.

Seen only once at Sinhè at about 3000 ft., when several specimens were procured. All have an exceedingly rufous tinge with very little green about them. The sub-terminal black patches on the tail feathers are very large and well-marked.

*Family LANIIDÆ.*

77 (474). *LANIUS COLLUIROIDES*, Lesson.

*Faun. Brit. Ind., Birds*, I, p. 462.

Universally distributed.

78 (475). *LANIUS NIGRICEPS*, Franklin.

*Faun. Brit. Ind., Birds*, I, p. 463.

Fairly common up to 6000 ft. Frequents localities well-provided with grass jungle. (H.N.T.)

79 (484). *HEMIPUS PICATUS*, Sykes.

*Faun. Brit. Ind., Birds*, I, p. 471.

Common in wooded localities. Particularly plentiful at Kalaw 4500 ft.

80 (488). *TEPHRODORNIS PONDICERIANUS*, Gmelin.

*Faun. Brit. Ind., Birds*, I, p. 475.

Confined to rather dry forest up to 4000 ft. (H.N.T.)

81 (490). *PERICROCOTUS SPECIOSUS*, Lath.

*Faun. Brit. Ind., Birds*, I, p. 479.

One of the commonest birds in the States.

82 (500). *PERICROCOTUS PEREGRINUS*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 487.

Common in dry forests at low and medium elevations.

83-(505). *CAMPOPHAGA MELANOSCHISTA*, Hodgs.

*Faun. Brit. Ind., Birds*, I, p. 491.

Fairly common in dry forest up to 4500 ft. (H.N.T.)

\*84 (510). *GRAUCALUS MACII*, Less.

*Faun. Brit. Ind., Birds*, I, p. 496.

Confined to the dry oak and *Dipterocarpus* forests up to 4000 ft. (H.N.T.).

85 (512). *ARTAMUS FUSCUS*, Vieill.

*Faun. Brit. Ind., Birds*, I, p. 498.

Very common in some places. Probably migrates locally from State to State. Wherever it is met with it is found in large flocks. Very partial to old clearings (*taungyas*) where it perches on the dead tree tops, sallying forth every now and then catching insects on the wing. (H.N.T.).

*Family ORIOLIDÆ.*

86 (515). *ORIOIUS TENUIROSTRIS*, Blyth.

*Faun. Brit. Ind., Birds*, I, p. 503.

I procured one specimen of this species at Payingon in the north-western corner of the Yatsank State. (H.N.T.).

\*87 (521). *ORIOIUS MELANOCEPHALUS*, Linn.

*Faun. Brit. Ind., Birds*, I, p. 506.

Both heard and seen on several occasions during the tour in the low hot valleys.

88 (522). *ORIOIUS TRAILLI*, Vigors.

*Faun. Brit. Ind., Birds*, I, p. 508.

Kalaw 4400 ft. One specimen procured. Rare; seems to go about in parties of three and four.

*Family EULABETIDÆ.*

89 (524). *EULABES INTERMEDIA*, A. Hay.

*Faun. Brit. Ind., Birds*, I, p. 511.

Common in the large forests at the foot of the hill ranges in the States. (H.N.T.).

*Family STURNIDÆ.*

90 (538). *STURNIA MALABARICA*, Gmelin.

*Faun. Brit. Ind., Birds*, I, p. 527.

Two specimens procured below Kalaw at about 3000 ft.

91 (539). *STURNIA NEMORICOLA*, Jerd.

*Faun. Brit. Ind., Birds*, I, p. 528.

Common in the more wooded portions of the States where it replaces *S. malabarica*. (H.N.T.). Not observed on Loi-San-Pa.

92 (546). *GRACULIPICA NIGRICOLLIS*, Payk.

*Faun. Brit. Ind., Birds*, I, p. 534.

Found occasionally in small parties in the plateaus bordering some of the rivers up to an altitude of 3000 ft. Seen also in April building a large conspicuous nest of grass, rags and feathers. I have lately found a nest on the top of a cactus bush near Yatsank. (H.N.T.).

Procured in the paddy fields round Mông Pông and Mông Lông at 2000 to 3500 ft.

\*93 (549). *ACRIDOTHERES TRISTIS*, Linn.  
*Faun. Brit. Ind., Birds, I, p. 537.*

\*94 (552). *ÆTHIOPSAR FUSCUS*, Wagler.  
*Faun. Brit. Ind., Birds, I, p. 539.*

Both these species were seen and identified near the lake at Fort Stedman.

95 (553). *ÆTHIOPSAR GRANDIS*, Moore.  
*Faun. Brit. Ind., Birds, I, p. 541.*

96 (554). *ÆTHIOPSAR ALBICINCTUS*, Godw.-Aust. and Wald.  
*Faun. Brit. Ind., Birds, I, p. 541.*

Both these Mynas are common throughout the States, especially round cultivation and villages. We procured them from Thamakhan to Mông Lông 3000 ft. and above.

\*97 (556). *STURNOPASTOR SUPERCILIARIS*, Blyth.  
*Faun. Brit. Ind., Birds, I, p. 543.*  
Fairly common. (H.N.T.).

*Family MUSCICAPIDÆ.*

98 (560). *SIPHIA STROPHIATA*, Hodgs.  
*Faun. Brit. Ind., Birds, II, p. 8.*  
Loi-San-Pa 6000 ft.

99 (562). *SIPHIA ALBICILLA*, Pall.  
*Faun. Brit. Ind., Birds, II, p. 10.*  
Bow-ya-that 3000 ft. One specimen.

100 (569). *CYORNIS MELANOLEUCUS*, Tick.  
*Faun. Brit. Ind., Birds, II, p. 18.*  
I procured two specimens of this bird in the Yatsank State at 4000 ft., and other specimens on Loi-San-Pa 6000 ft. (H.N.T.).

101 (570). *CYORNIS ASTIGMA*, Hodgs.  
*Faun. Brit. Ind., Birds, II, p. 19.*  
One specimen procured at Yebok in the Yatsank State at about 3000 ft.

102 (571). *CYORNIS SAPPHIRA*, Tick.  
*Faun. Brit. Ind., Birds, II, p. 20.*  
Loi-San-Pa at 4500 ft.

103 (572). *CYORNIS OATESI*, Salvadori.

*Faun. Brit. Ind., Birds*, II, p. 20.

Fairly common in the evergreen forests on the slopes of Loi-San-Pa from 4000 ft. upwards.

104 (575). *CYORNIS RUBECULOIDES*, Vigers.

*Faun. Brit. Ind., Birds*, II, p. 23.

Met with on several occasions at 2000 ft. and above. Common at Kalaw 4400. Two specimens procured.

105 (577). *CYORNIS MAGNIROSTRIS*, Blyth.

*Faun. Brit. Ind., Birds*, II, p. 26.

Lower slopes of Loi-San-Pa at between 3000 and 4000 ft. One specimen.

106 (578 bis). *CYORNIS BREVIROSTRIS*, Bingham.

*Ann. & Mag. Nat. Hist., Lond.*, seventh series, vol. v, p. 359.

Kalaw 4000 ft. A true *Cyornis* in habits and coloration, but with a remarkable bill approaching in shape that of *Chelidorhynx*.

107 (579). *STOPAROLA MELANOPS*, Vigers.

*Faun. Brit. Ind., Birds*, II, p. 28.

Not uncommon at elevations of 3500 ft. and upwards. (H.N.T.). I found this species nesting in holes on the side of the cart road from Bernardmyo (6000 ft.) to Mogók, Ruby Mines District, in April.

108 (592). *CULICICAPA CEYLONENSIS*, Swains.

*Faun. Brit. Ind., Birds*, II, p. 38.

Very common.

109 (593). *NILTAVA GRANDIS*, Blyth.

*Faun. Brit. Ind., Birds*, II, p. 40.

This beautiful species was fairly common on Loi-San-Pa. It seems entirely confined to dense evergreen forests at high altitudes.

110 (594). *NILTAVA SUNDARA*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 41.

Not so often met with on Loi-San-Pa as the preceding species. Confined like it to altitudes above 6000 ft.

111 (599). *TERPSIPHONE AFFINIS*, Hay.

*Faun. Brit. Ind., Birds*, II, p. 47.

One specimen was procured in the Yatsauk State at 3500 ft. (H.N.T.).

112 (601). *HYPOTHYMIS AZUREA*, Bodd.

*Faun. Brit. Ind., Birds*, II, p. 49.

Met with on the western borders of the States below 3000 ft.

113 (603). *CHELIDORHYNX HYPOXANTHUM*, Blyth.

*Faun. Brit. Ind., Birds*, II, p. 51.

Rare. One specimen, too much damaged for preservation, was procured on Loi-San-Pa at 6000 ft.

114 (605). *RHIPIDURA ALBICOLLIS*, Vieill.

*Faun. Brit. Ind., Birds*, II, p. 53.

Common. The only Fantail met with.

*Family TURDIDÆ.*

115 (608). *PRATINCOLA CAPRATA*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 59.

We met with this bird everywhere, apparently occurs all over the States.

116 (610). *PRATINCOLA MAURA*, Pall.

*Faun. Brit. Ind., Birds*, II, p. 61.

Generally found near grass jungle sparsely provided with trees.

\*117 (611). *PRATINCOLA LEUCURA*, Blyth.

*Faun. Brit. Ind., Birds*, II, p. 63.

Common on the shores of the Inlè lake near Fort Stedman, and from thence to Bow-ya-that along the road, frequenting the high grass skirting the lake and swampy depressions by the side of the road. (H.N.T.). Near Bow-ya-that I saw several, but failed to secure a specimen. (C.T.B.).

118 (615). *OREICOLA FERREA*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 66.

Very common.

119 (633). *HENICURUS IMMACULATUS*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 85.

Rather rare; confined to the beds of rocky streams. It does not ascend to any great height. (H.N.T.). Two specimens were procured at elevations between 3000 and 4000 ft. I saw it once on Loi-Sau-Pa at about 6000 ft. (C.T.B.).

120 (638). CHIMARRHORNIS LEUCOCEPHALUS, Vigors.

*Faun. Brit. Ind., Birds*, II, p. 89.

This species, so common in the valley of the Chindwin, seems rare in the States. Two specimens were procured near streams in dense evergreen forest.

121 (641). RUTICILLA AUREORA, Pall.

*Faun. Brit. Ind., Birds*, II, p. 93.

The common Redstart of the central plateau. (H.N.T.).

122 (646). RHYACORNIS FULIGINOSUS, Vigors.

*Faun. Brit. Ind., Birds*, II, p. 98.

Met with only on one occasion, when a specimen was secured at the foot of Loi-San-Pa at about 2500 ft. Confined to streams with heavily-wooded banks. (H.N.T.).

\*123 (663). COPSYCHUS SAULARIS, Linn.

*Faun. Brit. Ind., Birds*, II, p. 116.

Extremely common at all altitudes, except in very dense jungle.

\*124 (664). CITTOCINCLA MACRURA, Gmelin.

*Faun. Brit. Ind., Birds*, II, p. 118.

Not uncommon in the well-wooded portions of the States. (H.N.T.).

125 (676). MERULA BOULBOUL, Lath.

*Faun. Brit. Ind., Birds*, II, p. 130.

One ♀ was procured by me on the plateau in the north-west corner of the Yatsank State at 3600 ft. Several others were seen, but I was not fortunate enough to bag any of them. The males were very rare, I saw only two against six or seven females met with. At that time of the year they seem confined to the evergreen strips of jungle bordering the streams. (H.N.T.).

\*126 (677). MERULA ATRIGULARIS, Temm.

*Faun. Brit. Ind., Birds*, II, p. 131.

One was observed by us both quite close to our camp on Loi-San-Pa 6000 ft.

\*127 (679). MERULA PROTOMOMELÆNA, Cab.

*Faun. Brit. Ind., Birds*, II, p. 133.

This thrush is common at Taunggyi 4700 ft. During the rainy season it has a most delightful song that it keeps up for hours. The



song can be heard at a distance of very nearly a mile. They breed in the strip of jungle bordering the vegetable garden at Taunggyi. It also occurs on the Loi-Lem range.

128 (690). *PETROPHILA ERYTHROGASTRA*, Vigors.

*Faun. Brit. Ind., Birds*, II, p. 143.

One specimen, Kalaw 4400 ft.

129 (693). *PETROPHILA CYANUS*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 146.

Common. Every rest-house on the road from Thazi to Taunggyi seemed to be frequented by one or more of these birds. A most silent bird. (H.N.T.).

130 (698). *OREOCINCLA DAUMA*, Lath.

*Faun. Brit. Ind., Birds*, II, p. 152.

Seems to be rare. One specimen was procured at the foot of Loi-San-Pa 2500 ft.

I have shot it on the Salween-Mèkong watershed at 6500 ft. (H.N.T.).

131 (710). *CINCLUS PALLASI*, Temm.

*Faun. Brit. Ind., Birds*, II, p. 164.

Rare. I have only observed this Dipper in one other locality in these States, in streams in the trans-Salween Sub-State of Mèsègun on the Siamese frontier. (H.N.T.).

Two specimens, a pair, were shot by Mr. Thompson at the foot of Loi-San-Pa 2500 ft. Both specimens when fresh had the distinctive mark of "the legs plumbeous in front."

These birds are difficult to shoot. Affecting steep, rocky, densely wooded streams, they keep flying on ahead as you approach and dodge round the corners rapidly, barely affording a glimpse of their dark bodies.

#### *Family PLOCEIDÆ.*

132 (724). *PLOCEËLLA JAVANENSIS*, Less.

*Faun. Brit. Ind., Birds*, II, p. 180.

Common. We met with this bird everywhere in grass jungles near water.

133 (726). *MUNIA ATRICAPILLA*, Vieill.

*Faun. Brit. Ind., Birds*, II, p. 183.

Fairly common in the grass plains in the lake valley. (H.N.T.).

134 (728). *UROLONCHA STRIATA*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 185.

Met with once in the Mông Pông Sub-State at about 2500 ft.

135 (735). *UROLONCHA PUNCTULATA*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 189.

One specimen was procured by me on the plateau in the north-west corner of the Yatsauk State at 3500 ft. in March, 1900. Several flocks were noticed at the time. (H.N.T.).

\*136 (739). *SPORÆGINTHUS FLAVIDIVENTRIS*, Wallace.

*Faun. Brit. Ind., Birds*, II, p. 193.

Not uncommon round the borders of the lake at Fort Stedman 3000 ft.

*Family FRINGILLIDÆ.*

137 (761). *CARPODACUS ERYTHRINUS*, Pall.

*Faun. Brit. Ind., Birds*, II, p. 219.

Loi-San-Pa at about 4000 ft. Very local in its distribution. (H.N.T.).

\*138 (776). *PASSER DOMESTICUS*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 236.

The Common Sparrow was seen occasionally only at Fort Stedman.

139 (779). *PASSER MONTANUS*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 240.

The common house sparrow of these States. (H.N.T.). Was observed common round most of the towns and villages.

140 (781). *PASSER FLAVEOLUS*, Blyth.

*Faun. Brit. Ind., Birds*, II, p. 242.

Rather common. Both this and the preceding species build in my house at Taunggyi. (H.N.T.).

141 (791). *EMBERIZA PUSILLA*, Pall.

*Faun. Brit. Ind., Birds*, II, p. 254.

Met with on several occasions in small flocks at Taunggyi 4700 ft., and on Loi-San-Pa at 6000 ft.

142 (797). *EMBERIZA AUREOLA*, Pall.

*Faun. Brit. Ind., Birds*, II, p. 259.

Rare. (H.N.T.). One specimen was shot out of a flock near Bow-ya-that, at about 3000 ft. elevation.

143 (801). *EMBERIZA RUTILA*, Pall.

*Faun. Brit. Ind., Birds*, II, p. 263.

Rare. I have procured this species on the Salween-Mèkong watershed at 6000 ft. close to the town of Kengtung. (H.N.T.).

144 (803). *MELOPHUS MELANICTERUS*, Gmelin.

*Faun. Brit. Ind., Birds*, II, p. 265.

This beautiful Bunting was met with plentifully, avoiding only heavy forest.

*Family HIRUNDINIDÆ.*

145 (809). *COTILE SINENSIS*, J. E. Gray.

*Faun. Brit. Ind., Birds*, II, p. 273.

Common in suitable localities. (H.N.T.). One specimen procured at Mõng Lõng at about 2500 ft. Several were observed flying in and out of burrows in a perpendicular bank on the Nam-lan stream.

146 (818). *HIRUNDO SMITHII*, Leach.

*Faun. Brit. Ind., Birds*, II, p. 280.

Common and a permanent resident on the plateau. (H.N.T.). Numbers were seen perched on the telegraph wires along the road from Kalaw to Taunggyi.

147 (820). *HIRUNDO STRIOLATA*, Temm.

*Faun. Brit. Ind., Birds*, II, p. 281.

Common and a resident species on the central plateau, being found there and at Taunggyi at all times of the year. (H.N.T.). One specimen shot near Mõng Lõng.

148 (823). *HIRUNDO ERYTHROPYGIA*, Sykes.

*Faun. Brit. Ind., Birds*, II, p. 283.

One specimen was procured in the Mõng Kõng State about 3000 ft. elevation out of several that were hawking about. It was seen nowhere else, and apparently was migrating, for 10 days later, returning to the same camp, not a single individual was to be seen.

*Family MOTACILLIDÆ.*

149 (827). *MOTACILLA LEUCOPSIS*, Gould.

*Faun. Brit. Ind., Birds*, II, p. 288.

Met with commonly along the road-sides and by the streams.

\*150 (839). *LIMONIDROMUS INDICUS*, Gmelin.

*Faun. Brit. Ind., Birds*, II, p. 300.

Rare. Confined to the low well-wooded valleys. (H.N.T.).

151 (841). *ANTHUS MACULATUS*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 304.

This Pipit was excessively common, alike on the bare plateau and in the wooded valleys. Near Hlaingdet on the Thazi-Taunggyi road I came on a rather large green tree snake (*Tragops prasinus*) which had got hold of an individual of this species by the head. The bird was still alive and fluttering vigorously, but when released from the snake's mouth seemed unable to fly away and expired in about an hour.

152 (847). *ANTHUS RUFULUS*, Vieill.

*Faun. Brit. Ind., Birds*, II, p. 308.

Common. This and the preceding species were the only Pipits seen, neither *A. striolatus* nor *A. richardi* was met with.

#### Family ALAUDIDÆ.

\*153 (861). *ALAUDA GULGULA*, Frankl.

*Faun. Brit. Ind., Birds*, II, p. 326.

Very common on the high plateaux. (H.N.T.).

154 (873). *MIRAFRA MICROPTERA*, Hume.

*Faun. Brit. Ind., Birds*, II, p. 336.

One specimen was procured at Kalaw 4300 ft. It is common in the plains below at Thazi.

#### Family NECTARINIIDÆ.

155 (882). *ÆTHOPYGA SEHERIÆ*, Tickell.

*Faun. Brit. Ind., Birds*, II, p. 348.

Common from the lowest altitudes up to 3600 ft. I have lately procured several specimens in the Yatsauk State. The males of this species are very pugnacious and chase each other about. A male in possession of a tree will not allow another to come near it. The males of *Æ. dabryi* and *Æ. gouldiæ* are much more tolerant of each others presence. (H.N.T.).

156 (888). *ÆTHOPYGA GOULDIÆ*, Vigors.

*Faun. Brit. Ind., Birds*, II, p. 352.

Loi-San-Pa at 6000 ft.; observed nowhere else. (H.N.T.).

157 (889). *ÆTHOPYGA DABRYI*, J. Verr.

*Faun. Brit. Ind., Birds*, II, p. 353.

Loi-San-Pa 6000 ft. and above. Confined to high altitudes. Common on Loi-San-Pa. (H.N.T.).

158 (890). *ÆTHOPYGA SATURATA*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 354.

Loi-San-Pa at 6000 ft. and upwards. Very common on the flowers of the wild cherry.

159 (895). *ARACHNECHTHEA ASIATICA*, Lath.

*Faun. Brit. Ind., Birds*, II, p. 359.

Confined as a rule to the lower altitudes in the States, rarely ascending above 4000 ft. (H.N.T.). Two specimens procured, Taunggyi 4700 feet, and Kalaw 4300 feet.

160 (906). *ARACHNOTHERA MAGNA*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 369.

Fairly common in well-wooded parts. Has a very distinct call which I have heard mimicked by *Chloropsis hardwickii*. (H.N.T.). Loi-San-Pa from the foot up to about 6000 feet.

#### *Family DICEIDÆ.*

161 (912). *DICEUM CRUENTATUM*, Linn.

*Faun. Brit. Ind., Birds*, II, p. 376.

Found at elevations from 1000 to 4000 feet. (H.N.T.). This pretty little species was common at most places along our route, working about bunches of creepers and flowers. It was not observed either at Taunggyi or on Loi-San-Pa above 4000 feet.

162 (914). *DICEUM CHRYSORRHÆUM*, Temm.

*Faun. Brit. Ind., Birds*, II, p. 378.

Less common than the preceding species. (H.N.T.). One specimen procured at about 2500 ft. elevation.

163 (915). *DICEUM IGNIPECTUS*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 378.

Loi-San-Pa at 4000 ft. and upwards.

164 (917). *DICEUM OLIVACEUM*, Wald.

*Faun. Brit. Ind., Birds*, II, p. 380.

Kalaw and Loi-San-Pa at 4000 feet and upwards.

165 (925). *PACHYGLOSSA MELANOXANTHA*, Hodgs.

*Faun. Brit. Ind., Birds*, II, p. 386.

This very beautiful Flower-pecker was only twice seen and procured, a ♂ in the Yatsauk State at about 2500 feet elevation, and a ♀ on Loi-San-Pa at 6000 feet. Like all the *Dicæidæ* it is a restless little bird, frequenting bunches of creepers and flowers and twisting in and out among them in incessant motion.

*Family PICIDÆ.*

166 (948). *GEVINUS STRIOLATUS*, Blyth.

*Faun. Brit. Ind., Birds*, III, p. 20.

Seen only once, and a specimen procured in the Yatsauk State at 2500 ft. elevation.

167 (950). *GEVINUS OCCIPITALIS*, Vigors.

*Faun. Brit. Ind., Birds*, III, p. 22.

Met with on several occasions, but not above 4000 feet.

168 (954). *GEVINUS NIGRIGENIS*, Hume.

*Faun. Brit. Ind., Birds*, III, p. 26.

Not uncommon in the dry forests. One specimen at about 2500 ft. shot in company with a number of *Garrulus leucotis*.

169 (960). *HYPOPICUS HYPERYTHRUS*, Vigors.

*Faun. Brit. Ind., Birds*, III, p. 32.

It appears to prefer dry oak forest to other jungle. (H.N.T). Kalaw 4300 ft., Yatsauk State 2500 ft. to about 4000 ft.

170 (968). *DENDROCOPIUS ATRATUS*, Blyth.

*Faun. Brit. Ind., Birds*, III, p. 40.

Loi-San-Pa at 6000 feet and above.

171 (975). *IYNGIPICUS CANICAPILLUS*, Blyth.

*Faun. Brit. Ind., Birds*, III, p. 46.

Met with in dry forest on the plateau between Yatsauk and Mông Pông at about 3000 feet. Occurs at Taunggyi 4800 ft.

172 (988). *TIGA JAVANENSIS*, Ljung.

*Faun. Brit. Ind., Birds*, III, p. 61.

Common in dry forest. This species goes about in mobs in company with *Gecinus nigrigenis*, Jays, Drongos, &c. (H.N.T.).

\*173 (996). *HEMILOPHUS PULVERULENTUS*, Temm.

*Faun. Brit. Ind., Birds*, III, p. 71.

\*174 (998). *THRIPONAX FEDDENI*, Blanford.

*Faun. Brit. Ind., Birds*, III, p. 73.

Both these birds were met with during our tour more than once, but no specimens were obtained. The former affects more dense and moister forests than the latter, which is essentially a bird of the dry forests.

\*175 (1003). *IYNX TORQUILLA*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 78.

Common on the Taunggyi plateau in the winter. (H.N.T.).

*Family CAPITONIDÆ.*

176 (1007). *MEGALÆMA VIRENS*, Bodd.

*Faun. Brit. Ind., Birds*, III, p. 86.

One specimen Loi-San-Pa at 6000 feet. Universally distributed over the States in high forest over 3000 feet. (H.N.T.).

177 (1009). *THEREICERYX LINEATUS*, Vieill.

*Faun. Brit. Ind., Birds*, III, p. 88.

Common. Occasional specimens have the sides of the neck, breast, and upper abdomen pale dirty brown without any lineation.

178 (1012). *CYANOPS ASIATICA*, Lath.

*Faun. Brit. Ind., Birds*, III, p. 92.

Was commonly met with.

179 (1018). *CYANOPS RAMSAYI*, Wald.

*Faun. Brit. Ind., Birds*, III, p. 97.

Found in dense forests at altitudes of 5800 ft. and above. (H.N.T.).  
Common on Loi-San-Pa above 6000 ft.

180 (1019). *XANTHOLEMA HÆMATOCEPHALA*, P. L. S. Müller.

*Faun. Brit. Ind., Birds*, III, p. 98.

Common in the lower hot valleys. One specimen was procured on Loi-San-Pa above 6000 ft.

*Family CORACIADÆ.*

\*181 (1023). *CORACIAS AFFINIS*, McClell.

*Faun. Brit. Ind., Birds*, III, p. 105.

Common.

182 (1025). EURYSTOMUS ORIENTALIS, Linn.

*Faun. Brit. Ind., Birds*, III, p. 107.

Common in heavy jungle in the northern parts of the Yatsank State. (H.N.T.).

*Family MEROPIDÆ.*

183 (1026). MEROPS VIRIDIS, Linn.

*Faun. Brit. Ind., Birds*, III, p. 110.

Common. Ascends up to 6000 ft., at which altitude one specimen was procured on Loi-San-Pa.

184 (1030). MELITTOPHAGUS SWINHOI, Hume.

*Faun. Brit. Ind., Birds*, III, p. 114.

Common in some of the low valleys of the States. (H.N.T.). One shot below Kalaw at about 3000 ft., but too much damaged to preserve.

185 (1031). NYCTIORNIS ATHERTONI, Jard. & Selby.

*Faun. Brit. Ind., Birds*, III, p. 115.

Rather uncommon in the States. (H.N.T.). Two specimens procured between Taunggyi and Fort Stedman. Elevation about 3500 ft.

*Family ALCEDINIDÆ.*

\*186 (1033). CERYLE VARIA, Strickland.

*Faun. Brit. Ind., Birds*, III, p. 119.

Seen during the tour near several of the streams. Common around the lake at Fort Stedman.

\*187 (1034). CERYLE LUGUBRIS, Vigors.

*Faun. Brit. Ind., Birds*, III, p. 121.

Occasionally found at the head waters of some of the larger streams in very dense dark forest. (H.N.T.).

188 (1035). ALCEDO ISPIDA, Linn.

*Faun. Brit. Ind., Birds*, III, p. 122.

Common.

\*189 (1043). PELARGOPSIS GURIAL, Pearson.

*Faun. Brit. Ind., Birds*, III, p. 129.

Common in the low valleys. (H.N.T.).

190 (1044). HALCYON SMYRNENSIS, Linn.

*Faun. Brit. Ind., Birds*, III, p. 132.

Met with commonly along our route.



191 (1045). *HALCYON PILEATA*, Bodd.

*Faun. Brit. Ind., Birds*, III, p. 133.

Rather rare. Found at low altitudes only. (H.N.T.).

*Family BUCEROTIDÆ.*

\*192 (1051). *DICHO CEROS BICORNIS*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 142.

The Great Hornbill was both seen and heard on several occasions in the Yatsauk State.

193 (1053). *ANTHRACOCEROS ALBIROSTRIS*, Gmelin.

*Faun. Brit. Ind., Birds*, III, p. 145.

Common. At the town of Mōng Pōng 2000 ft. elevation we were encamped under a *Ficus* tree in fruit, which was all day long frequented by this species in crowds.

194 (1054). *RHYTIDOCEROS UNDULATUS*, Shaw.

*Faun. Brit. Ind., Birds*, III, p. 147.

I have only seen and shot this species in the evergreen forests skirting the banks of the Mèkōng river in the Kengtung State. (H.N.T.).

195 (1057). *ACEROS NEPALENSIS*, Hodgs.

*Faun. Brit. Ind., Birds*, III, p. 149.

Rare. Confined to the heavy forest on the highest hill ranges. (H.N.T.). One specimen procured on Loi-San-Pa at about 7000 ft.

*Family UPUPIDÆ.*

196 (1067). *UPUPA INDICA*, Reich.

*Faun. Brit. Ind., Birds*, III, p. 161.

The Indian Hoopoe was fairly common in the Yatsauk State.

*Family CYPSELIDÆ.*

197 (1086). *MACROPTERYX CORONATA*, Tick.

*Faun. Brit. Ind., Birds*, III, p. 180.

Fairly common in the more wooded portions of the States.

Other Swifts and Swiftlets were seen, but none sufficiently close for identification. Among the latter a Palm Swiftlet was fairly common at Kalaw, but no specimens were secured.

*Family CAPRIMULGIDÆ.*

198 (1091). *CAPRIMULGUS ASIATICUS*, Lath.

*Faun. Brit. Ind., Birds*, III, p. 186.

This species was frequently put up along the road in scrub jungle. It does not seem to affect high forest.

199 (1095). *CAPRIMULGUS INDICUS*, Lath.

*Faun. Brit. Ind., Birds*, III, p. 190.

One specimen seen and procured on Loi-San-Pa at about 7000 ft.

\*200 (1096). *LYNCORNIS CERVINICEPS*, Gould.

*Faun. Brit. Ind., Birds*, III, p. 192.

Common all over the States in suitable localities. (H.N.T.). Its ringing trisyllabic cry was heard once or twice on the plateau between Yatsauk and Möng Pöng.

*Family TROGONIDÆ.*

201 (1101). *HARPACTES\* ERYTHROCEPHALUS*, Gould.

*Faun. Brit. Ind., Birds*, III, p. 200.

Common. Confined to the lower valleys. (H.N.T.). One specimen was shot at Wetpyuyè 2800 ft., but unfortunately was so damaged by the shot as to be passed preservation.

*Family CUCULIDÆ.*

\*202 (1104). *CUCULUS CANORUS*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 205.

Very common all over the States in the hot weather. (H.N.T.).

203 (1108). *HIEROCOCCYX SPARVERIOIDES*, Vigors.

*Faun. Brit. Ind., Birds*, III, p. 211.

One specimen procured at Kyauk-ku in the northern portion of the Yatsauk State about 3200 ft. in March. (H.N.T.).

204 (1113). *CACOMANTIS MERULINUS*, Scop.

*Faun. Brit. Ind., Birds*, III, p. 218.

Met with only between Fort Stedman and Sinhè. At Bow-ya-that 3500 ft. it was common, affecting the trees and bushes along the roadside.

\* *Harpactes*, Swainson, 1837, is pre-occupied by *Harpactes*, Templeton, 1884, used for a genus of *Arachnida*.

205 (1114). *PENTHOCERYX SONNERATI*, Lath.

*Faun. Brit. Ind., Birds*, III, p. 219.

Kalaw at 5000 ft. One specimen.

206 (1120). *EUDYNAMIS HONORATA*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 228.

Very common up to altitudes of 4000 ft. (H.N.T.).

207 (1123). *RHOPODYTES TRISTIS*, Less.

*Faun. Brit. Ind., Birds*, III, p. 232.

Rare. (H.N.T.). Seen and procured at Nanpandet 2000 ft., and at Wetpyuyè 2800 ft.

\*208 (1130). *CENTROPUS SINENSIS*, Steph.

*Faun. Brit. Ind., Birds*, III, p. 239.

Common. (H.N.T.).

#### *Family PSITTACIDÆ.*

209 (1142). *PALEORNIS FINSCHI*, Hume.

*Faun. Brit. Ind., Birds*, III, p. 254.

This is the common Paraquet met with throughout the States.

210 (1150). *LORICULIS VERNALIS*, Sparrm.

*Faun. Brit. Ind., Birds*, III, p. 261.

I have shot this species in the State of Môngpan and Mawkmai. (H.N.T.).

#### *Family STRIGIDÆ.*

211 (1152). *STRIX FLAMMEA*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 264.

Found at Taunggyi. I have taken the nests on low bushes and rocks on swampy ground near Taunggyi. There were three young in each nest. (H.N.T.).

212 (1160). *SYRNIUM INDRANI*, Sykes.

*Faun. Brit. Ind., Birds*, III, p. 275.

On the Crag at Taunggyi 4400 ft. (H.N.T.).

#### *Family ASIONIDÆ.*

213 (1166). *KETUPA JAVANENSIS*, Less.

*Faun. Brit. Ind., Birds*, III, p. 283.

I have shot this species in trans-Salween Mawkmai. (H.N.T.).

\*214 (1170). HUHUA NEPALENSIS, Hodgs.

*Faun. Brit. Ind., Birds*, III, p. 287.

Occasionally found in the heavy forest at the foot of the high ranges.

215 (1180). ATHENE BRAMA, Temm.

*Faun. Brit. Ind., Birds*, III, p. 301.

Common in the Pein Valley Mawkmai State. (H.N.T.). One specimen procured just above Nanpandet at about 2000 ft. elevation.

216 (1183). GLAUCIDIUM CUCULOIDES, Vigors.

*Faun. Brit. Ind., Birds*, III, p. 305.

Wetpynyè 2800 ft. One specimen procured.

\*217 (1187). NINOX SCUTULATA, Raffl.

*Faun. Brit. Ind., Birds*, III, p. 309.

Very common all over the States, except at the higher elevations. (H.N.T.).

*Family PANDIONIDÆ.*

218 (1189). PANDION HALIAËTUS, Linn.

*Faun. Brit. Ind., Birds*, III, p. 314.

I have procured this bird on the lake at Fort Stedman, and also on the Loikaw river.

*Family VULTURIDÆ.*

\*219 (1191). OTOGYPS CALVUS, Scop.

*Faun. Brit. Ind., Birds*, III, p. 318.

Common. (H.N.T.). Two specimens were seen at close quarters round the carcass of a dog near the Fort Stedman lake.

\*220 (1196). PSEUDOGYPS BENGALENSIS, Gmelin.

*Faun. Brit. Ind., Birds*, III, p. 324.

Common. Generally met with during our tour.

*Family FALCONIDÆ.*

221 (1202). AQUILA BIFASCIATA, J. E. Gray.

*Faun. Brit. Ind., Birds*, III, p. 336.

This is the commonest true Eagle that is found in the Southern Shan States. Leaves the country in May. (H.N.T.). One specimen at Bow-ya-that 3000 ft.

222 (1205). *AQUILA MACULATA*, Gmelin.

*Faun. Brit. Ind., Birds*, III, p. 340.

I have shot this species close to the town of Mongnai. (H.N.T.).

\*223 (1208). *HIERAËTUS PENNATUS*, Gmelin.

*Faun. Brit. Ind., Birds*, III, p. 344.

Sparsely distributed all over the States, except on the highest hills in the winter.

224 (1212). *SPIZAËTUS LIMNAËTUS*, Horsf.

*Faun. Brit. Ind., Birds*, III, p. 351.

Very common in the heavy jungles at the foot of the hill ranges. (H.N.T.). Two specimens obtained at about 2500 ft. elevation in the Mông Pông Sub-State.

225 (1217). *SPILORNIS CHEELA*, Lath.

*Faun. Brit. Ind., Birds*, III, p. 357.

Common in the low valleys. I procured a young specimen with only just the faintest traces of spots on the plumage of the lower parts. (H.N.T.).

226 (1221). *BUTASTUR LIVENTER*, Temm.

*Faun. Brit. Ind., Birds*, III, p. 364.

Common. Confined to dry *eng* forest up to 3500 ft. I saw an individual chase a Shikra (*Astur badius*) and make it drop a lizard that it was carrying off. The Buzzard then got possession of the lizard. (H.N.T.). One specimen shot near the foot of Loi-San-Pa about 3000 ft.

\*227 (1228). *HALIASTUR INDUS*, Bodd.

*Faun. Brit. Ind., Birds*, III, p. 372.

Confined to the low valleys. Often seen on the shores of the Inlè lake, Fort Stedman. (H.N.T.).

\*228 (1229). *MILVUS GOVINDA*, Sykes.

*Faun. Brit. Ind., Birds*, III, p. 374.

Common. Disappears in the rains and returns at the end of October. (H.N.T.).

\*229 (1230). *MILVUS MELANOTIS*, Temm.

*Faun. Brit. Ind., Birds*, III, p. 377.

Common in the well-wooded States. (H.N.T.).

230 (1232). *ELANUS CÆRULEUS*, Desf.

*Faun. Brit. Ind., Birds*, III, p. 379.

Seen once or twice in the Yatsauk State. One specimen obtained in the plains between Bow-ya-that and Hèho 4000 ft.

\*231 (1236). *CIRCUS MELANOLEUCUS*, Forster.

*Faun. Brit. Ind., Birds*, III, p. 385.

Common. Does not leave the plateau till the end of May. (H.N.T.).

\*232 (1237). *CIRCUS ÆRUGINOSUS*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 387.

Common. Was seen more than once near the lake at Fort Stedman, and at Yatsauk.

233 (1238). *CIRCUS SPILONOTUS*, Kaup.

*Faun. Brit. Ind., Birds*, III, p. 388.

Rare. One specimen procured near Mông Pông at about 2000 ft.

234 (1244). *ASTUR BADIUS*, Gmelin.

*Faun. Brit. Ind., Birds*, III, p. 398.

Specimens of only the lighter Burmese form (*Astur poliopsis*, Hume) were procured between Taunggyi and Fort Stedman, and at Kalaw.

235 (1246). *LOPHOSPIZIAS TRIVIRGATUS*, Temm.

*Faun. Brit. Ind., Birds*, III, p. 401.

Rare. I have shot it at Taunggyi. (H.N.T.).

236 (1247). *ACCIPITER NISUS*, Linn.

*Faun. Brit. Ind., Birds*, III, p. 402.

Rare. One specimen procured on the road between Taunggyi and Fort Stedman at about 5000 ft. elevation. The specimen, a ♂, is a remarkably large one. Length 17", Wing 10.1".

\*237 (1255). *FALCO PERIGRINATOR*, Sundev.

*Faun. Brit. Ind., Birds*, III, p. 415.

Has bred for the last three years on the steep rock known as "The Crag" at Taunggyi. (H.N.T.).

\*238 (1257). *FALCO JUGGER*, G. E. Gray.

*Faun. Brit. Ind., Birds*, III, p. 419.

Common in the low hot open valleys. (H.N.T.).

We saw but failed to secure an individual of this species which

frequented a group of trees in the great paddy plain lying between the town of Mōng Lōng and the foot of Loi-San-Pa in the Mōng Kōng State, elevation about 3000 ft.

239 (1260). *FALCO SUBBUTEO*, Linn.  
*Faun. Brit. Ind., Birds*, III, p. 422.

Passes through as a migrant. (H.N.T.). One specimen, a very richly coloured ♂, was obtained near the town of Yatsauk.

240 (1261). *FALCO SEVERUS*, Horsf.  
*Faun. Brit. Ind., Birds*, III, p. 423.

Found sparingly in the well-wooded States. I have obtained it at Yatsauk. (H.N.T.).

\*241 (1262). *ERYTHROPUS AMURENSIS*, Gurney.  
*Faun. Brit. Ind., Birds*, III, p. 424.

This species passes through the States every year on its journey back to Northern Asia. It migrates in parties of several hundred individuals, and only remains in any one place for a day or so. The date on which the birds appear in the Southern Shan States is very constant, and is about the 15th April. On that date I observed it in Mawkmai in 1897, and in 1898. I saw it in large parties in the Yatsauk State on the 18th April. Again in 1899 I met with it near Kengtung on the 16th April, while this year (1900) I noticed large numbers of them at Taunggyi on the 14th April. (H.N.T.).

242 (1265). *TINNUNCULUS ALAUDARIUS*, Gmelin.  
*Faun. Brit. Ind., Birds*, III, p. 428.

Common. (H.N.T.). One specimen procured at Kalaw 4300 ft.

243 (1267). *MICROHIERAX EUTOLMUS*, Blyth.  
*Faun. Brit. Ind., Birds*, III, p. 432.

Common. Not found above 4000 ft. as a rule. (H.N.T.). Two specimens procured in the Yatsauk State, one at Wetsyuyè.

#### *Family COLUMBIDÆ.*

244 (1271). *CROCOPTUS PHENICOPTERUS*, Lath.  
*Faun. Brit. Ind., Birds*, IV, p. 5.

Common in heavy hill jungle. (H.N.T.). Procured on the fruiting *Ficus* trees at Sinhè 4000 ft., and in the Yatsauk State.

\*245 (1281). *TRERON NEPALENSIS*, Hodgs.

*Faun. Brit. Ind., Birds*, IV, p. 14.

Common on the high ranges. (H.N.T.).

246 (1283). *SPHENOCERCUS SPHENURUS*, Vigors.

*Faun. Brit. Ind., Birds*, IV, p. 16.

Common on the high ranges. Found up to 6000 ft. (H.N.T.).

A ♀ was obtained on Loi-San-Pa at about 7000 ft.

247 (1287). *DUCULA GRISEICAPILLA*, Wald.

*Faun. Brit. Ind., Birds*, IV, p. 22.

Common up to all altitudes at suitable times of the year. (H.N.T.).

Only one specimen was procured during our tour; and it was only seen and heard in January on Loi-San-Pa at and above 6000 ft.

248 (1291). *CHALCOPHAPS INDICA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 26.

Confined to the low-lying hot valleys. I once procured the skin of a new species of this genus in the Mawkmai forests. This bird differed in having a *pure white* (not grey) rump. The bill and feet were of a horny-brown colour and not red. Otherwise it agreed with *C. indica*. Unfortunately the skin was destroyed by dogs before I could return to head-quarters. I noticed several individuals in the forest in which I shot the specimen noted above.

249 (1297). *DENDROTRERON HODGSONI*, Vigors.

*Faun. Brit. Ind., Birds*, IV, p. 33.

"I have procured a most extraordinary bird for these hills (the eastern slopes of the Crag at Taunggyi), *viz.*, the Spotted Wood-pigeon. This bird according to Blanford is confined to the Himalayas and Eastern Thibet at altitudes of from 10,000 to 13,000 ft. in the summer. I procured it at Taunggyi last Sunday 22nd April (the hottest time of the year here is the end of April), on the Crag at about an altitude of 5600 ft. I saw several others at the same time." (Extract from a letter dated 24th April from Mr. Thompson).

250 (1304). *TURTUR ORIENTALIS*, Lath.

*Faun. Brit. Ind., Birds*, IV, p. 40.

This dove was very common. Several specimens were procured.

\*251 (1309). *TURTUR CAMBATENSIS*, Gmelin.

*Faun. Brit. Ind., Birds*, IV, p. 45.

Common. (H.N.T.). Observed during the tour near the towns of Mông Pông and Mông Lông.



252 (1312). *MACROPYGIA TUSALIA*, Hodgs.

*Faun. Brit. Ind., Birds*, IV, p. 49.

Decidedly rare. I lately procured a very fine specimen in the N.-W. portion of the Yatsank State at an altitude of 3600 ft.

*Family PHASIANIDÆ.*

253 (1328). *GALLUS FERRUGINEUS*, Blyth.

*Faun. Brit. Ind., Birds*, IV, p. 75.

Common. I have not found this species at altitudes above 4500 ft. (H.N.T.).

254 (1331). *PHASIANUS HUMILÆ*, Hume.

*Faun. Brit. Ind., Birds*, IV, p. 80.

Found at Kalaw, on the hill behind Taunggyi, very common in trans-Salween Mawkmai at 3500 ft., and I have recently put up a magnificent male at Payingon on the plateau in the N.-W. corner of the Yatsank State. (H.N.T.).

255 (1340). *GENNÆUS LINEATUS*, Vigors.

*Faun. Brit. Ind., Birds*, IV, p. 92.

One ♂ out of a small party of three or four shot at Wetpyu-yè 2800 ft.

\*256 (1352). *BAMBUSICOLA FITCHII*, Anderson.

*Faun. Brit. Ind., Birds*, IV, p. 110.

Common. (H.N.T.). Met with on one occasion only during the tour, at Taunggyi 4800 ft.

257 (1356). *COTURNIX COROMANDELICA*, Gmelin.

*Faun. Brit. Ind., Birds*, IV, p. 116.

Common at Hèho in the rains.

258 (1363). *ARBORICOLA RUFIGULARIS*, Blyth.

*Faun. Brit. Ind., Birds*, IV, p. 126.

One ♂ specimen procured on Loi-San-Pa at about 6000 ft. It belongs to the sub-species or variety named *A. tickelli* by Hume.

259 (1374). *FRANCOLINUS CHINENSIS*, Osbeck.

*Faun. Brit. Ind., Birds*, IV, p. 138.

Very common on the plateaux but was not seen or heard on Loi-San-Pa. This bird has a habit of sitting on trees by the roadside, from whence it keeps uttering its characteristic call:

*Family TURNICIDÆ.*

260 (1382). *TURNIX PUGNAX*, Temm.

*Faun. Brit. Ind., Birds*, IV, p. 151.

Common. (H.N.T.). One specimen was procured in the Yatsauk State at about 2500 ft.

*Family RALLIDÆ.*

261 (1402). *GALLINULA CHLOROPUS*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 175.

This species was common on the lake at Fort Stedman and on the marsh near Yatsauk.

\*262 (1404). *PORPHYRIO POLIOCEPHALUS*, Lath.

*Faun. Brit. Ind., Birds*, IV, p. 178.

The same remark applies to this as to the preceding species.

\*263 (1405). *FULICA ATRA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 180.

Apparently not so common as the two preceding species.

*Family GRUIDÆ.*

\*264 (1410). *GRUS SHARPII*, Blanf.

*Faun. Brit. Ind., Birds*, IV, p. 189.

Close to the lake of Fort Stedman a couple of parties of this species were seen sufficiently close for identification. So far as my observation goes this bird does not build nearly as large a nest as *G. antigone*. Its cry too seems to me to differ somewhat.

*Family GLAREOLIDÆ.*

265 (1425). *GLAREOLA ORIENTALIS*, Leach.

*Faun. Brit. Ind., Birds*, IV, p. 214.

Yatsauk State, on the Honan plain. (H.N.T.).

266 (1427). *GLAREOLA LACTEA*, Temm.

*Faun. Brit. Ind., Birds*, IV, p. 216.

In the valley of the Yong-Mawkmai State. (H.N.T.).

*Family PARRIDÆ.*

267 (1428). *METOPIDIUS INDICUS*, Lath.

*Faun. Brit. Ind., Birds*, IV, p. 218.

Very common on all the tanks. (H.N.T.).

268 (1429). *HYDROPHASIANUS CHIRURGUS*, Scop.

*Faun. Brit. Ind., Birds*, IV, p. 219.

A few were seen and one shot near Bow-ya-that.

*Family CHARADRIIDÆ.*

269 (1432). *SARCOGRAMMUS ATRINUCHALIS*, Blyth.

*Faun. Brit. Ind., Birds*, IV, p. 226.

Very common. (H.N.T.). One specimen at Hèho.

\*270 (1435). *HOPLOPTERUS VENTRALIS*, Wagl.

*Faun. Brit. Ind., Birds*, IV, p. 229.

Common on the banks of the larger rivers, such as the Salween and Mèkong. (H.N.T.).

271 (1439). *CHARADRIUS FULVUS*, Gmelin.

*Faun. Brit. Ind., Birds*, IV, p. 234.

Common on the shores of the lake at Fort Stedman and at Hèho. (H.N.T.).

272 ( ? ). *ÆGIALITIS sp. ?*

A Sand Plover was procured by me near Hèho 4200 ft., but was carelessly lost by my servant who was carrying it before it was examined and identified.

273 (1460). *TOTANUS HYPOLEUCUS*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 260.

Met with at Kalaw, Fort Stedman, Bow-ya-that, &c.

274 (1461). *TOTANUS GLAREOLA*, Gmelin.

*Faun. Brit. Ind., Birds*, IV, p. 261.

Sinhè 4300 ft.

Near the lake at Fort Stedman and on the road to Bow-ya-that a few Stints of kinds were seen but not procured or identified, I am sorry to say.

275 (1482). *SCOLOPAX RUSTICULA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 283.

Common. Several are shot every year at Taunggyi. (H.N.T.).

276 (1483). *GALLINAGO NEMORICOLA*, Hodgs.

*Faun. Brit. Ind., Birds*, IV, p. 285.

Common in the marshes to the south of Taunggyi, where several couple are shot every year. (H.N.T.).

277 (1484). *GALLINAGO CÆLESTIS*, Frenzel.  
*Faun. Brit. Ind., Birds*, IV, p. 286.

278 (1485). *GALLINAGO STENURA*, Kuhl.  
*Faun. Brit. Ind., Birds*, IV, p. 289.

Both species of Snipe are common. The latter is perhaps more plentiful than the former.

279 (1487). *GALLINAGO GALLINULA*, Linn.  
*Faun. Brit. Ind., Birds*, IV, p. 292.

A few are shot every year on the shores of the Fort Stedman lake. It is also found at Hopong Saga and Mawkmai. (H.N.T.).

280 (1488). *ROSTRATULA CAPENSIS*, Linn.  
*Faun. Brit. Ind., Birds*, IV, p. 293.  
Very common. (H.N.T.).

*Family LARIDÆ.*

281 (1491). *LARUS BRUNNEICEPHALUS*, Jerdon.  
*Faun. Brit. Ind., Birds*, IV, p. 301.  
Two specimens procured on the Fort Stedman lake.

282 (1496). *HYDROCHELIDON HYBRIDA*, Pallas.  
*Faun. Brit. Ind., Birds*, IV, p. 307.

Found on the Fort Stedman lake. I have not noticed it anywhere else except on the Salween river. (H.N.T.). Three specimens procured.

*Family PHALACROCORACIDÆ.*

\*283 (1526). *PHALACROCORAX CARBO*, Linn.  
*Faun. Brit. Ind., Birds*, IV, p. 340.

\*284 (1528). *PHALACROCORAX JAVANICUS*, Horsf.  
*Faun. Brit. Ind., Birds*, IV, p. 342.

Both species are common in the States in suitable localities. (H.N.T.).

\*285 (1529). *PLOTUS MELANOGASTER*, Pennant.  
*Faun. Brit. Ind., Birds*, IV, p. 344.

Very common. (H.N.T.). I passed within a few feet of one seated on a fishing stake in the lake at Fort Stedman. (C.T.B.).

*Family IBIDIDÆ.*

\*286 (1544). PLEGADIS FALCINELLUS, Linn.

*Faun. Brit. Ind., Birds, IV, p. 364.*

Not uncommon. (H.N.T.). A small flock was seen but unfortunately out of shot, in the swamp near the town of Mông Lông 3000 ft.

*Family CICONIDÆ.*

287 (1548). DISSURA EPISCOPUS, Bodd.

*Faun. Brit. Ind., Birds, IV, p. 370.*

One shot at Mông Pông 2500 ft. Seems, in the States, to keep to the banks of streams.

\*288 (1550). LEPTOPTILUS DUBIUS, Gmelin.

*Faun. Brit. Ind., Birds, IV, p. 373.*

Rare. I have seen it close to the Mèkong river and once at Taunggyi. (H.N.T.).

*Family ARDEIDÆ.*

\*289 (1566). ARDEOLA BACCHUS, Bonap.

*Faun. Brit. Ind., Birds, IV, p. 394.*

Found throughout the States. (H.N.T.).

I believe I saw *A. grayi* too, several times, but no specimen was shot, and I cannot be certain that I identified it correctly. (C.T.B).

\*290 (1568). NYCTICORAX GRISEUS, Linn.

*Faun. Brit. Ind., Birds, IV, p. 397.*

Common. (H.N.T.).

*Family ANATIDÆ.*

291 (1589). DENDROCYCNA JAVANICA, Horsf.

*Faun. Brit. Ind., Birds, IV, p. 430.*

Very common.

292 (1591). NETTOPUS COROMANDELIANUS, Gmelin.

*Faun. Brit. Ind., Birds, IV, p. 433.*

Common. Specimens of both the above were shot on the Fort Stedman lake.

293 (1593). ANAS PEGILORHYNCHA, Forst.

*Faun. Brit. Ind., Birds, IV, p. 436.*

Common. This and the next species meet at the lake, Fort Stedman, and intermediate individuals (hybrids) are often shot. (H.N.T.).

294 (1593 *bis*). *ANAS ZONORHYNCHA*, Swinh.\*

Common. (H.N.T.). Met with during our tour on the Fort Stedman lake and at Mōng Pōng.

295 (1595). *CHAULELASMUS STEPERUS*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 440.

Abundant at Mongnai and on the marshy ground bordering the Thabet Chaung (stream) in the Hopong and Waung Wun States.

296 (1600). *DAFILA ACUTA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 447.

Common. (H.N.T.).

297 (1601). *QUERQUEDULA CIRCIA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 449.

Common. (H.N.T.). This and the preceding species was not uncommon on the Fort Stedman lake in December and January.

\*298 (1602). *SPATULA CLYPEATA*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 452.

Rather rare. Found on the Fort Stedman lake and the Mongnai tanks. (H.N.T.).

299 (1606). *NYROCA FERRUGINEA*, Gmelin.

*Faun. Brit. Ind., Birds*, IV, p. 460.

I have shot this species on the small tank at Mongnai. (H.N.T.).

#### *Family PODICIPEDIDÆ.*

300 (1615). *PODIPES CRISTATUS*, Linn.

*Faun. Brit. Ind., Birds*, IV, p. 473.

I once obtained a pair on the Inlè lake, Fort Stedman, in December.

\*301 (1617). *PODIPES ALBIPENNIS*, Sharpe.

*Faun. Brit. Ind., Birds*, IV, p. 475.

Common. (H.N.T.).

\* This Duck is not given in the *Faun. Brit. Ind., Birds*, but is mentioned in part ii, p. 148, of the second part of Mr. Eugene W. Oates' "A Manual of the Game Birds of India" (1899), and is described in the *Cat. Birds B. M.*, vol. xxvii, p. 211, n. 13 (1895). Mr. Oates calls this species the Chinese Grey Duck, and proposes for it and for two other species the new generic name of *Polionetta*. It has been previously recorded from Indian limits from Kentung in the Shan States in the "Asian" Newspaper (10th January, 1899), according to Mr. Oates. [Ed.].

VII.—*On the Form of Cormorant inhabiting the Crozette Islands.*—By  
F. FINN, B.A., F.Z.S., Deputy Superintendent of the Indian Museum.

(With exhibition of specimen.)

[Received 30th May; Read 6th June, 1900.]

In the British Museum Catalogue of Birds, vol. xxvi, p. 394, Mr. W. B. Ogilvie-Grant refers the Cormorant of the Crozette Islands to *Phalacrocorax verrucosus*, with a mark of doubt. It may therefore be of interest to ornithologists to know that we have in the Indian Museum, among the specimens belonging to the Asiatic Society, the type of Blyth's *Hypoleucus melanogenis* (sic), which came from the Crozettes, and was received in 1860 from the late Mr. E. L. Layard, on behalf of the Government Museum, Cape Town, together with numerous skins of South African Mammals and Birds. As the reference, in J.A.S.B., vol. xxix, p. 101, has apparently been overlooked by the author of the Catalogue, I give it below in full:—" \*HYPOLEUCUS MELANOGENIS, nobis, n.s. Very like *H. varius* (Gm., *Ph. hypoleucos*, Gould), of Australia, but distinguished by its black cheeks and crest-feathers  $1\frac{3}{4}$  in. long. Wing  $10\frac{1}{2}$  in. Tail 5 in. Bill to forehead  $2\frac{1}{8}$  in. Foot 4 in. From the 'Crozettes.'"

The asterisk indicates that the species was new to the Asiatic Society's collection. The skin was mounted, but has been long ago dismounted, and is now in a rather bad state. It bears part of a paper label with the name, locality, and reference to description in Blyth's handwriting. A later label repeats the information, with the addition of the donor's name.

On comparing the specimen in question with the excellent figures and descriptions of the *Hypoleucus* group of Cormorants in the volume of the British Museum Catalogue above referred to, it is seen to be obviously most closely allied to *Phalacrocorax albiventer* and *P. verrucosus*, being generally purple-black above, glossed green on wings, and white below from chin to vent, and the feet having evidently been orange, not black as in *P. varius*, with which Blyth compared it. The chin-feathering extending barely before the gape, and the black cheeks noticed by Blyth evidently ally it to the two first-named species; and it further agrees with the former of these in the black not extending down the side of the lower jaw, and in the possession of a moderate white alar bar; the smaller dimensions, however, bring it nearer to *P. verrucosus*, with which it almost exactly agrees in this respect, and to this species I should be inclined to refer it, unless it be considered distinct, in which case the Crozette Island Cormorant will stand as *Phalacrocorax melanogenys* (Blyth).

VIII.—*On Two Rare Indian Pheasants*.—By F. FINN, B.A., F.Z.S.,  
Deputy Superintendent of the Indian Museum, and LIEUTENANT H. H.  
TURNER.

(With exhibition of specimens.)

[Received 30th May; Read 6th June, 1900.]

The Pheasants I am dealing with in the present brief paper were met with in the Chin Hills during the present year by Lieutenant H. H. Turner, who is responsible for the accompanying notes in brackets, and who submitted his specimens of the birds to me for identification.

*Phasianus humix.*

A typical male of this species, agreeing with the Manipur form, of which we have a specimen in the Museum, not with the nearly white-rumped Ruby Mines race or species discriminated by me in J.A.S.B., vol. lxvi, pt. 2, p. 523, and since named by Mr. Oates (*Ibis*, 1898, p. 124) *Calophasis burmannicus*.

[I had left my camp, which was pitched about six miles from Fort White, on the evening of the 6th March, to go after some Hill Partridge, which one of my men had seen just below my camp; not seeing any signs of them, I walked on for about a mile, and was returning along the road (the Fort White—Kalemyo road), when glancing down the *khud* I saw something grey disappearing in the long grass just below me. I immediately started to go after it, when I saw what appeared to me a light blue streak just disappearing. I immediately fired, but it was with faint hopes that I walked up to the spot, as not only did I think the bird had disappeared before I shot, but I had just at the moment of shooting slipped. I was therefore very much delighted when I saw the blue streak tumbling down the *khud* below me. I immediately went after him and secured him; as I was descending the original grey bird, which was evidently the female, got up and flew a short distance. I walked her up, and my dog again put her up; unfortunately, owing to the thick jungle, I was unable to get a shot. Walking on, however, I put up another, whether a cock or hen I could not say, as it was already dusk. I fired, but the bird flew away, and although I believe it dropped, I could not find it. These birds when I saw them were feeding amongst the dry leaves which littered the ground.

The next evening I tried the upper side of the road and put several (four at least) of these same birds out of some long grass on a steep hill-side. I only managed to get one long shot, which was not successful. I again tried the next morning, and was successful in bagging another; my dog put it up on our right, and flying very



low through the bushes it crossed just in front of me. Unfortunately the bird was not well skinned and I had to throw this specimen away.

The specimen that I have retained is a full-grown cock; the other one was a young cock without the long tail; the plumage was otherwise identical with that of the other bird. The hill on which I obtained these specimens was between 4000 and 5000 feet high, being one of the spurs of the Chin Hills running down into the Kale valley, and the birds were close to the Fort Kalembo—Fort White road, just about at milestone 20. The latitude is approximately 23°, and the longitude approximately 94°.]

*Gennæus davisoni* ?

A pair of Kalij procured by Lieutenant Turner appear to come nearest to what Mr. W. R. Ogilvie-Grant (Cat. B. M. Birds, vol. xxii, p. 304), and Dr. W. T. Blanford (Faun. Brit. Ind., Birds, vol. iv, p. 95), call by the above name. The male resembles that of *G. horsfieldi* in size, and in form of tail, and possesses equally well-marked white bands on the feathers of the lower back and rump. It differs, however, markedly in having the feathers of the upper surface behind the head, wings, and tail, *all* clearly though finely pencilled with white irregular lines, the line on the white-tipped back and rump feathers which precedes the white band at the tip being separated from it by a black space about equal in breadth to the band itself. A few of the feathers of the black under-surface are similarly but less clearly pencilled with white upon their outer webs.

It is thus intermediate between *G. horsfieldi* and *G. andersoni*\* (with the type of which I have compared it) but far more nearly approaches the former, not having the long curved tail and crest of the latter, and with the white pencillings much reduced in breadth and less regular. There is also no tendency to plain whiteness in the middle or to blackness in the outer tail-feathers, all being equally black with white pencilling. It must also very closely resemble Mr. E. W. Oates' *G. williamsi* from the same district, ("The Game Birds of India," vol. i, p. 342); but that bird has the light markings of the plumage buff and not white, except for the barring on the rump. It is quite different in character from the Asiatic Society's specimens of forms intermediate between *G. horsfieldi* and *G. lineatus*, the white markings in these being blurred and indistinct.

\* I have dealt with the question of the type of *G. andersoni* of Messrs. Elliot, Blanford, and Ogilvie-Grant in the *Ibis* (1899, p. 331), and photographs of this are now in the British Museum. The *G. andersoni* of Mr. Oates' work is the *G. davisoni* of the "Fauna" and the "Catalogue." [F.F.]

The female is like that of *G. horsfieldi*, but paler and duller, and with the stippling of the plumage more distinct; the black lateral tail-feathers also are pencilled with white, as in the male, but less regularly, and the pencilling tends to die out at the tips of the outer pairs.

This sex also therefore appears to closely correspond with Mr. Oates' *G. williamsi*, except again for the white pencilling, which also does not tend to disappear on the outermost feathers to the extent indicated by Mr. Oates. The facial skin in both birds has evidently been red, and the bill and feet horn-coloured, as in *G. horsfieldi*.

This form is thus distinguishable from any as yet described, and, if it should be thought worthy of a name, might be called *G. turneri*, after its discoverer; but I am very much averse to giving names to these numerous and variable forms of *Gennæus*, and hence range it provisionally under that subspecies of *G. horsfieldi* to which it bears the most resemblance. To *G. lineatus* I should say that it had no relationship, unless *G. andersoni* be indeed, as Dr. Blanford suggests, a cross between this species and *G. nycthemerus*. But without breeding together *G. nycthemerus*, *G. horsfieldi*, and *G. lineatus* in confinement and noting the result, I do not see how the status of these numerous more or less pencilled forms of the genus is to be settled. The buff pencilling in some of the species described by Mr. Oates is peculiarly difficult to account for, except on the supposition that they are all really distinct, which seems to me most improbable *à priori*.

[The two (cock and hen) Kalij were shot by me on the 15th March, 1900, on the road between Kalewa and Minza, Kalewa being an important village on the Chindwin from whence supplies are sent up to the Chin Hills; Minza is a small village 20 miles or so to the south of Kalewa, the birds being shot about 12 miles from Kalewa. When first I saw them they were in the thick bushes on the bank of a small stream, but they immediately flew into the bamboo jungle, and it was here that I shot them. I shot another the next morning close to the same spot, but my dog so spoilt the skin that I had to eat the bird instead of skinning it, and very excellent eating it was. I had already shot a hen of this species (I think there is little doubt that it *was* the same, though rather darker than the female I mentioned above) at Yasygo, a village in the Kale valley about 50 miles to the north. It was shot, however, at such close quarters that the skin was ruined.

The latitude in which the above pair were found is approximately 23°, and the longitude approximately 94° 30'; the elevation was between 600 and 800 feet.]

IX.—*Notes on the Structure and Function of the Tracheal Bulb in male Anatidæ.*—By F. FINN, B.A., F.Z.S., Deputy Superintendent of the Indian Museum.

[Received 30th May; Read 6th June, 1900.]

The peculiar bony, or bony and membranous, bulbs found at the base of the trachea in so many males of the duck tribe, are well known to be confined to individuals of that family and sex alone. But, well known as the *Anatidæ* are or should be, from the fact that so many species are shot for food or kept in captivity, thus making specimens easily available for dissection, this structure of the trachea does not appear to have been recorded in some even of the best known species, nor does its functional importance ever appear to have been fully realized. It is my purpose here to note briefly some specific peculiarities in the form of the organ which seem to have escaped the notice of naturalists, and to conclude with some observations on its presumable use.

*Nettopus coromandelianus.*

In writing a popular series of articles in the *Asian* newspaper in 1898-99, destined for sportsmen who wished to identify the ducks they shot, I was careful to note the structure of the trachea in each species when I was able to give the information, in hopes of interesting my readers in this point. Thus I mentioned that the male of the above species was devoid of a tracheal bulb, a fact I had ascertained from my own examination of the trachea of this bird. Dr. W. T. Blanford, in a letter to me on the subject, has informed me that this observation is new, and I am hence induced to record it here. I find, however, that Sir E. Newton (*Ibis*, 1863, p. 459), says of *Nettopus auritus*, "Unlike most other ducks, the trachea of the male in this species is of a very simple form, there being scarcely any enlargement whatever at the lower extremity." It is possible, therefore, that the absence of a tracheal bulb may characterize the genus, as appears to be the case with *Erimatura*, in which genus MacGillivray, presumably referring to *E. rubida*, states that "There is no expansion or tympanum, as in other ducks" (*Orn. Biogr.*, vol. iv, 1838, p. 331, *vide* Beddard, *Structure and Classification of Birds*, p. 464, footnote). Pallas certainly states (*Zoog. Ross. As.*, vol. ii, p. 285), that such a tympanum is absent in *E. leucocephala*, a fact which I have been able personally to verify (see J.A.S.B., vol. lxvi, pt. 2, p. 527). It would, however, be rash to assume that such deficiency of the tracheal bulb must necessarily apply to all the species of these genera, since among the members of the genus

*Oidemia, O. nigra* alone is exceptional in having no difference of this kind between the sexes.

*Aix galericulata.*

Well-known as is the Mandarin duck, I have been unable to find any reference to a description of the tracheal structure of the male, and I therefore venture to record that there exists in this sex of the species a large, rather flattened, thin-walled bony bulb of rounded outline, somewhat resembling that of the Muscovy (*Cairina moschata*).

*Cairina moschata* × *Anas boschas.*

It may be of interest to note that the male hybrid between these two domestic ducks, judging from two specimens of each species and of the hybrid examined by me, agrees with the Mallard in the size and form of the tracheal bulb, but has this rather thinner-walled, thus approaching the structure of the very thin-walled bulb found in the Muscovy drake, the very flattened and expanded form of which is characteristic.

*Casarca rutila.*

I have been unable to discover any mention of the form of the male trachea in this species, and so was unable to give any account of it when writing the series above-mentioned. Since then, however, I have obtained a specimen, and find the bulb present and bony-walled, but very small, only about the size of a pea, thus differing very much from the great double inflation found in *Tadorna cornuta*.

FUNCTION OF THE TRACHEAL BULB IN DRAKES.

There can be no doubt that the use of this peculiar structure is to modify the voice of the owner, as was pointed out, indeed, by Yarrell ("British Birds," article Mallard) many years ago; but the fact needs drawing attention to, as it has been doubted, for Coues (*vide* Dresser, "Birds of Europe," article American Bittern) states that "The curious cartilaginous or osseous bulbs at the lower larynx of most Ducks seem to have no influence on the voice." But nothing could be further from the truth. Yarrell (*loc. cit.*) approvingly quotes Gilbert White's observation on the sexual difference of voice in Ducks; and careful study of the living birds will show that in nearly every case where the tracheal enlargement exists in the male, he emits a correspondingly different note from the female—generally one of a weaker character, if not always. The accompanying table will make this point clear.

*With a bony bulb in trachea of male.*

| Name.                         | Voice of Male.                       | Voice of Female.                   |
|-------------------------------|--------------------------------------|------------------------------------|
| <i>Carina moschata.</i>       | A panting hiss.                      | A sharp quack.                     |
| <i>Aix galericulata.</i>      | A snorting whistle ( <i>weesh!</i> ) | A quacking sneeze ( <i>atch!</i> ) |
| <i>Chenalopex ægyptiacus.</i> | A husky chatter.                     | A harsh barking quack.             |
| <i>Eunetta falcata.</i>       | A whistling cry like a duckling's.   | A quack five times repeated.       |
| <i>Dafila acuta.</i>          | A faint weak quack.                  | A harsh single quack.              |

*With a partly bony, partly membranous bulb in trachea of male.*

|                                   |                                             |                                                                        |
|-----------------------------------|---------------------------------------------|------------------------------------------------------------------------|
| <i>Rhodonessa caryophyllacea.</i> | A melodious double call ( <i>wugh-ah!</i> ) | Not known; but never gives the male note, while the drake often calls. |
| <i>Nyroca baeri.</i>              | A faint low quack.                          | A harsh croak ( <i>karr!</i> )                                         |
| <i>Nyroca africana.</i>           | "                                           | "                                                                      |
| <i>Merganser castor.</i>          | A harsh croak ( <i>karr!</i> )              | A short abrupt quack.                                                  |

Of course many more well-known cases could be given, but I have in the above table merely given some, which being imperfectly or not at all recorded, have attracted my special notice. *Casarca rutila* is an exception proving the rule, since in this bird the tracheal bulb of the male is, as above noted, singularly small, and there appears to be no difference between the voice of the sexes in consequence. Authors in describing the sexual difference in the voices of various *Anatidæ*, often speak as if the quack were common to both sexes, and another note peculiar to the male alone. At other times no sexual distinction in voice is mentioned, as in Hume's account of the Pintail (*Dafila acuta*) "Game Birds of India," vol. iii, p. 193). The same explanation will, I think, account for both errors, the birds having been studied from a distance when in flocks, and the cries of the separate birds thus having been confused. With regard to our two domestic ducks (*Anas boschas* and *Cairina moschata*) the drakes seem quite incapable of giving the duck's note, and *vice versâ*, and I think the same rule will be found to apply throughout. That there are certain species, like *Nettopus coromandelianus* and *Ædemia nigra*, in which the male has no tracheal bulb and yet gives a different call from the female, in no way invalidates the importance of this structure in the others; for the voices of male birds, in the *Gallinæ* and *Passeres* for instance, often differ from those of females without any corresponding difference in anatomical structure. The tracheal bulb in the *Anatidæ*, where found, merely, in my opinion, makes such difference necessary and permanent.

X.—*Note on Calinaga, an aberrant genus of Asiatic Butterflies*.—By  
LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

[Received 5th June; Read 4th July, 1900.]

In the "Memoirs and Proceedings of the Manchester Literary and Philosophical Society," vol. xliii, part iv, n. 11, pp. 1-23, pls. iv, v and vi (1899), appears a paper by Mr. John Watson entitled "On *Calinaga*, the Single Genus of an aberrant Sub-Family of Butterflies," in which he has brought together a mass of most interesting facts mostly based on his own original observations regarding these butterflies. This paper should be carefully studied by everyone interested in the phylogeny of this anomalous genus.

The following brief notes will shew the very various positions in the natural order of Butterflies in which *Calinaga* has been placed by different writers:—

Dr. F. Moore in 1857 when first describing the genus placed it in the subfamily *Nymphaliniæ* next following the genus *Hestina*, Westwood; in 1865 he placed it at the end of the *Papilionidæ*, the *Pieridæ* being retained as a distinct family; in 1895 he replaced it in the family *Nymphalidæ*, but proposed a new subfamily for it, the *Calinaginiæ*, which will follow the subfamily *Nymphaliniæ*. In 1861 Dr. C. Felder placed it in the family *Nymphaliniæ* after the genus *Penthema*, Doubleday. Mr. W. F. Kirby in 1871 placed the genus second in the subfamily *Papilioniniæ*, but in 1877 he removed it to the *Nymphaliniæ*; in 1894 he stated that it belonged to the *Nymphalidæ*. In 1872 Herr Gustav Weymer noted that *Calinaga* does not belong to the *Papilioniniæ*, but to the *Pieriniæ*. In 1873 Mynheer P. C. T. Snellen placed *Calinaga* in the *Nymphaliniæ*. M. Charles Oberthür in 1881 noted that the antennal characters of the genus place it between a genus of *Pieriniæ* (*Leuconea*) and a genus of *Papilioniniæ* (*Parnassius*). M. H. Lucas in 1884 placed it in the same position as M. Oberthür in 1881. Dr. A. G. Butler in 1885 placed *Calinaga* in the *Nymphaliniæ*, but said that he had no doubt that its proper place is in the subfamily *Satyriniæ*. In 1886 Dr. O. Staudinger placed the genus in the subfamily *Nymphaliniæ*. In 1886 I placed it in the *Nymphaliniæ* wholly on account of the forelegs of the imago of the male being pectoral unfitted them for use in walking. At that date I had seen no female, the forelegs of which have since been found to be perfect but unfit for use in walking, being very small and pectoral as in the opposite sex. Dr. E. Schatz in 1887 placed *Calinaga* in the "Diademen" group, which is the fourth group in his seventh family "Nymphaliden." For *Diadema* the genus *Hypolimnas* is intended, as *Diadema* having been proposed in 1817 for a genus of *Crustacea*

cannot be used for the genus of Butterflies proposed by Boisduval in 1832. In 1888 Mr. H. J. Elwes placed the genus in the *Nymphaliniæ*. In 1892 Mr. J. H. Leech placed it in the *Nymphaliniæ*. In 1898 Dr. Karl Jordan placed the subfamily *Callinaginiæ* [sic!] in the family *Nymphalidæ*. Lastly in 1899 Mr. John Watson noted that the genus has "A great similarity to the *Papilionidæ* (subfamilies *Papilioninæ*, *Parnassiinæ*, and *Pierinæ*), and to the *Nymphalidæ* (subfamily *Danainæ*, but not to the subfamily which includes the genus *Hypolyminas*\*)." In writing to me on February 10th, 1900, Mr. Watson says that the genus "Must be placed next to (not in) the *Danainæ*."

Mr. Watson notes that the egg as far as he has been able to study it with very insufficient and imperfect material, *i.e.*, the broken upper portions of two eggs of *Calinaga davidis*, Oberthür, obtained from the dried body of the female, shews that *Calinaga* is near to the *Danainæ*, *i.e.*, to the genera *Hestia* and *Danais*. I have nothing to urge against this conclusion, in fact I agree with it so far that I think it probable that *Calinaga* is allied to the subgenus *Radena* of the genus *Danais*. The acquisition of a perfect freshly deposited egg would, I may note, settle definitely at once and for ever the position of this anomalous genus. I may note that Mr. W. Doherty has pointed out that *Radena nicobarica*, Wood-Mason and de Nicéville, has 16 vertical ribs on the egg, and that *Radena vulgaris*, Butler, has from 14 to 16 vertical ribs, and 25 cross-lines. When the egg of *Calinaga* is discovered it will be interesting to note if the vertical ribs and cross-lines agree with those of *Radena*. Mr. Doherty describes the eggs of the *Danainæ* as "Much higher than wide, leathery, radiate, with numerous broad flattened ribs and distinct cross-lines, reticulate over a small area at the apex." The micropyle of the eggs of butterflies is of little or no value for classificatory purposes.

As regards the foreleg, which in the male is very hairy, imperfect, having but a single joint to the tarsus, while in the female it is perfect, having five tarsal joints, the terminal joint furnished with a pair of claws, a pair of paronychialia, and a pulvillus, Mr. Watson notes that the female of *Calinaga* "Shews in its tarsal structure the most ancient type of leg of the whole of the *Nymphalidæ*." I have examined the forelegs of both sexes of *Calinaga*, which I could not do in 1886 when I dealt with the genus in the second vol. of "The Butterflies of India, Burmah and Ceylon," as at that date I had seen no female, from which it is clear that the genus cannot be placed in M. Constant Bar's group *Tetrapoda*, in which both sexes have the forefeet or tarsi imperfect, the *Tetrapoda* being

\* Recte *Hypolyminas*.

equivalent to the family *Nymphalidæ*, but that *Calinaga* should find a place in the *Heteropoda*, which has the forefeet imperfect in the male but perfect in the female, the *Heteropoda* being equivalent to the families *Lemoniidæ* and *Lycænidæ*. But to place *Calinaga* in either of those families on the structure of the forelegs only is obviously out of the question, as in every other respect the genus shews no relationship to those families. The forelegs of both sexes of *Calinaga* are highly specialised, and have lost all functional characters, being extremely small and quite unfitted for walking. This is a characteristic of the *Nymphalidæ*, but the fact that the male has a nymphalid foreleg, while the female has in structure a foreleg, which, but for its ridiculously small size unfitting it for use, would place the genus amongst the *Lemoniidæ*, *Lycænidæ*, *Papilionidæ* and *Hesperiidæ* which have six fully developed ambulatory legs in the female, removes the genus from any known family of butterflies as hitherto diagnosed, the structure of the forelegs having of recent years been largely used as a primary basis on which to divide the families.

*Calinaga* has a prototype in the genus *Pseudergolis*, usually also placed in the subfamily *Nymphaliniæ*, but for which Dr. Karl Jordan has proposed the subfamily name *Pseudergoliniæ*, the foreleg of the male of which has a single joint to the tarsus, the female having five tarsal joints, the terminal joint furnished with a pair of claws, a pulvillus, and bifid paronychialia. In both sexes in *Pseudergolis* the forelegs are very distinctly longer both actually and proportionally than in *Calinaga* (in while they are ridiculously short), but are still quite unfitted for walking. *Pseudergolis* therefore is another genus that can find no place as far as I can see in any existing family of butterflies as hitherto diagnosed. Its transformations (*Pseudergolis wedah*, Kollar) are known fortunately, and have been figured by me in Journ. Bomb. Nat. Hist. Soc., vol. xi, p. 371, n. 83, pl. U, figs. 9a, 9b, larva; 9c, 9d, 9e, 9f, pupa (1898). The full grown larva reminds one somewhat of that of the genus *Apatura* (= *Potamis*, Hübner, to follow Dr. F. Moore), subgenus *Rohana*, Moore, while the pupa is like that of the genus *Athyma*. Mr. Watson says that *Pseudergolis* "In point of general resemblance and neuration is undoubtedly in the *Precis* and *Junonia* section of the *Nymphaliniæ*." Mr. W. Doherty, who first discovered the abnormality in the forelegs of the female, placed it in the *Apaturidæ*, "Differing but little from its neighbours in other points [except the feet], if the feet offered really reliable characters" (Journ. A.S.B., vol. lx, pt. 2, p. 12 (1891). Mr. Doherty placed *Pseudergolis* in his *Junonia* group, which embraced the genera *Junonia*, *Precis*, *Pseudergolis* and *Rohana* (Journ. A.S.B., vol. lv, pt. 2, p. 123, n. 82 (1886).



With regard to the antennæ of *Calinaga*, Mr. Watson says that they are "Similar in general form to those of *Danais* and *Euplœa*, and in scaling are like those of the *Parassiniæ*." In my opinion the antennæ superficially most nearly resemble those of the genus *Luehdorfa* of the *Papilioninæ*, with which they agree very closely in length and shape. In *Calinaga* they are too short and stout to agree well with the *Danainæ*, and too long to agree with *Parnassius*, besides which the antennæ of the latter genus are more abruptly clubbed than in *Calinaga*, and the club is thicker. The structure of the legs and the neuration will, however, in my opinion, remove *Calinaga* entirely from the *Papilionidæ*.

With regard to the basal cell of the hindwing in *Calinaga*, which is caused by the peculiar conformation of the costal, subcostal and median nervures together with another vein called by Mr. Watson the "interno-costal nervule," that writer sums up the evidence as regards *Calinaga* that in formation it is "Similar to *Parnassius*, and dissimilar to the *Danainæ*, and still less similar to the genus *Hypolimnas*." I have nothing to add to this. The basal cell is found in the *Danainæ*, *Morphinæ*, *Pierinæ*, and *Papilioninæ*.

As regards the general facies of *Calinaga* I agree with Mr. Watson that it reminds one of the genus *Aporia* of the *Pierinæ*, still more so of some species of *Parnassius*, but in my opinion most of all to certain species of the subgenus *Radena* of the *Danainæ*, say *Radena meganira*, Godart, for the dark *Calinaga buddha*, Moore, and *Radena juvena*, Cramer, for the lighter *Calinaga davidis*, Oberthür, and *C. cercyon*, mihi. Neither of these species of *Radena*, however, occur where the *Calinagas* are found. The disposition and extent of the markings of the two genera *Radena* and *Calinaga* is very markedly similar. *Calinaga* is almost unique in the heavily hairy, ferruginous clothing of the thorax of both sexes of all the known species, which strongly contrasts with the black abdomen, and this hairiness is characteristic of *Parnassius*. The coloration feature of the thorax is also noticeable in *Parnassius citrinarius*, Motschulsky, of which *P. glacialis*, Butler, is a synonym, but in the latter species the coloured hairy clothing of the thorax is of much less extent, forming merely a collar, and is rather paler, more fulvous, in shade. I may note that the hairless, leathery abdomen of *Calinaga* reminds one of that of the genus *Danais*.

I can extend the geographical range of the genus *Calinaga* considerably beyond that given by Mr. Watson, as it is found in the Western as well as in the Eastern Himalayas, but it is a noticeable fact that as far as is at present known *C. buddha* occurs in the Western Himalayas only in the Kulu Valley, near Dalhousie, in Chumba, at Murree, and possibly near Mussoorie, there being an immense gap of

nearly 600 miles before it is again met with in Sikkim in the Eastern Himalayas; while to the east *C. davidis*, Oberthür, occurs in Central as well as in Western China, while *C. sudassana*, Melvill, is found in Upper Burma and Upper Siam.

Dr. George Watt obtained *Calinaga brahma*, Butler, which is a synonym of *C. buddha*, Moore, "Near Assam" according to Dr. Butler who described it, but Mr. J. H. Elwes has noted that the specimens were probably collected in the Naga Hills on the march from Manipur to Kohima. In Mr. Elwes' collection is a female specimen of *C. buddha* from Chumba in the Western Himalayas. *C. buddha* was originally described from N. India, presented by Colonel Buckley, who collected largely in the neighbourhood of Mussoorie in the Western Himalayas, but no specimens from the Mussoorie region have been obtained in recent years. Excepting Dr. Watt there is no European in India as far as I know who has seen a *Calinaga* alive except Mr. A. Grahame Young, who informs me that it is not very rare in the Kulu Valley, also in the Western Himalayas; that it frequents the banks of heavily wooded streams from 3,500 to under 6,000 feet elevation above the sea, never higher than that; that it is purely a forest insect, never found amongst mere brushwood but always amongst trees; and occurs generally from about 25th March to 20th May. He notes that once, and once only, he saw three altogether, in July, 1872. It is very fond of settling on wet sand or gravel, when disturbed it flies off with a strong *Papilio*-like flight, and that it is very strong on the wing. Last year (1899), Mr. Young tells me that his native collector reported that he saw over twenty specimens, but caught only five. In Kulu it is very local, Mr. Young knows of two spots only where it occurs.

In 1886 I noted that "The species [of *Calinaga*] are probably mimetic." I think so still, and that they mimic species of *Danais*, *C. buddha*, *C. davidis*, and *C. cercyon* mimicking *D. limniace*, Cramer, *C. sudassana* mimicking *D. sita*, Kollar (= *D. tytia*, Gray), and *C. lhatso*, Oberthür, possibly the same species; the mimic and its model in all cases being found in the same locality.

In conclusion I may note that the opinion I expressed in 1886 that "The proper position of the genus is amongst the *Nymphalidæ*, though a knowledge of its transformations is necessary for determining its exact position in that family" remains unaltered. Till its egg is properly known (eggs extracted from the body of a long deceased specimen are not very satisfactory, though very much better than nothing), and its larva and pupa are discovered, especially the young larva on first emergence from the egg, the position of the genus must remain uncertain. It is not a hesperid, papilionid, lycænid or lemoniidid, so must

come into the family *Nymphalidæ*. Various authors have placed it in the *Danainæ*, *Satyrinæ*, *Nymphaliniæ*, *Pierinæ*, and *Papilioninæ*. Its most probable position is I think in the subfamily *Danainæ* as Mr. Watson states, and I would place it tentatively after *Hestia* and *Ideopsis* and before *Danais*, next before the subgenus *Radena*. If, however, the male has no extrusible tufts of hairs at the end of the abdomen as have all the *Danainæ*, it cannot be placed in that subfamily. I think it probable that these tufts are absent. The structure of the forelegs of the female in correlation with that of the male removes the genera *Calinaga* and *Pseudergolis* from any hitherto known family of butterflies, if the sequence and definition of the rhopalocerous families is to be primarily based on the structure of the forelegs of the imago as has been done of recent years. But I think these two genera must come into the existing families as aberrant genera, the genus *Calinaga* amongst the *Danainæ* and the genus *Pseudergolis* amongst the *Nymphaliniæ*. In all five species of *Calinaga* are known. I have given a list of them in Journ. A.S.B., vol. lxvi, pt. 2, p. 551 (1897).

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XI.—*Notes on birds collected in Kumaon.*—By CAPTAIN  
H. J. WALTON, I.M.S.

[Received 6th June; Read 4th July, 1900.]

The birds enumerated in the following list were collected by me in British Garhwal and the Almora district of Kumaon during the months of April—July, 1899.

The nature of the duty on which I was engaged rendered it necessary for me to visit nearly the whole of British Garhwal, and most of the district lying east of Almora almost to the boundary of Nepal. Unfortunately my camps had to be selected without any reference to their merits as collecting grounds, and, indeed, as I was travelling nearly every day, most of the birds were shot actually from the roads.

Garhwal is a large district, extending far up into the Himalayas, bounded on the north by Thibet, on the west by Native Garhwal, and on the south and east by Kumaon. Although there are some very high peaks and mountain ranges, as a rule the valleys up which the roads run are rather low-lying, averaging about 6,000 feet, but varying from about 4,000 to 12,000 feet above sea-level. The sides of the valleys are almost everywhere covered with tree jungle, but from Chamoli to Yoshimath, and again in the neighbourhood of the Mana and Niti passes, the hillsides are almost bare. In parts the jungle is very thick

indeed, and as it is precisely in such places that many of the birds are met with, unless one has plenty of time at one's disposal, one is sure to overlook a great many species. The Garhwalis do not seem to take much interest in birds, and they are by no means skilful in marking down those that are shot. I lost a great many birds owing to the difficulty of finding them in thick undergrowth.

The climate of Garhwal, in summer, presents great and sudden variations. As one marches along, it is often very cold on the higher roads, and then, after a steep descent into a low-lying valley, the heat becomes very trying. This, of course, is a good thing in one respect, as the birds met with necessarily vary very much, even in the course of a single march.

At the beginning of April the weather was cold with a good deal of rain. The latter part of the month of May and the beginning of June were hot and fine. The rains began about the 10th of June, and soon became very heavy indeed. At the end of June and throughout July the birds were very silent: the jungles were wet and slippery and full of small but voracious leeches, and, consequently, not very attractive.

Nearly all the birds were breeding at the time I visited Kumaon: I regret that I had too little time at my disposal to devote any attention to nests. The choice lay between birds and eggs, and I preferred the former. All the pheasants were breeding or preparing to breed, and had retired into the depths of the jungles, consequently I did not see very many. I was shown a breeding-place of the White-bellied or Snow-pigeon (*Columba leuconota*) at the lower end of the Mana pass, but on May 20th, the date of my visit, the eggs had not been laid. I hope to receive some from the headman of the neighbouring village, later on. I also saw two breeding sites of the Alpine Swift (*Cypselus melba*) in rocky precipices above the Alaknanda river, but they were quite inaccessible.

I left Naini Tal on April 9th, and marching *viâ* Almora and Ranikhet, entered Garhwal on April 18th. I went first to Kedarnath, which is about 10,000 feet above sea-level in the north-west of the district. The roads were crowded with pilgrims on their way to the famous temple. These people come every year from all parts of India, most of them marching up the Ganges valley from Hurdwar, as soon as the fair there is over. I met pilgrims from Hyderabad (Deccan) and Quetta. The pilgrimage season lasts for about six months, and one can only hope that the spiritual benefits received are at all in proportion to the physical discomforts undergone by the pilgrims, many of them very old men and women. It was bitterly cold at Kedarnath, and snowed hard the day I was there (May 4th).

From Kedarnath I went *viâ* Ukhimath and Yoshimath to the

Mana Pass, which I reached on May 19th. By that date the weather was beginning to get much warmer, though the pass was not yet open. Thence my route was to the Niti pass. On May 31st, two Thibetans, the first of the year, had just crossed the pass, but they reported that they had been much delayed on the road by heavy snow-drifts. From the Niti pass I marched nearly due south, entering the Almora district on June 15th. I proceeded to Pithoragarh, in the east of the district, and returned to Naini Tal on July 17th.

The numbers and nomenclature adopted in the following list are those given by Messrs. Oates and Blanford in "The Fauna of British India, Birds."

1. *Corvus corax*.—I did not see any Ravens in Garhwal, but, according to native accounts, they visit the higher valleys in winter.

4. *Corvus macrorhynchus*.—The Jungle-Crow is common in all the valleys, except the very highest.

7. *Corvus splendens*.—The Indian House-Crow only occurs about the larger hill stations in Kumaon: I did not see any in Garhwal.

12. *Urocissa occipitalis*.—The Red-billed Blue Magpie is very common, up to about 6,000 feet, wherever there is tree or bush jungle.

13. *Urocissa flavirostris*.—Common at rather higher elevations than the last species.

18. *Dendrocitta himalayensis*.—Very common: seen generally in small parties of from four to six.

24. *Garrulus lanceolatus*.—Common up to about 6,000 feet: this bird feeds a great deal on the ground.

26. *Garrulus bispecularis*.—Also common: occurs up to rather higher elevations than *G. lanceolatus*.

29. *Graculus eremita*.—I did not see the Red-billed Chough below 10,000 feet. It was common near Badrinath, and the Mana pass. There were none at Kedarnath.

30. *Pyrhcorax alpinus*.—The Yellow-billed Chough was very common, and very tame, about Malari, and at one or two other places in Garhwal. The birds flew about the camp in a very unconcerned way. They have a much softer note than the Red-billed Chough.

31. *Parus atriceps*.—Common, at moderate altitudes.

34. *Parus monticola*.—Very numerous.

35. *Ægithaliscus erythrocephalus*.—Very common.

42. *Machlolophus aanthogenys*.—I only saw the Yellow-cheeked Tit once—near Naini Tal. A small party were feeding in some low trees on the banks of a small stream. I shot one specimen, but although I was constantly on the look-out for more, I did not see the bird again. I fancy, therefore, that it must be rather locally distributed in Kumaon.

44. *Lophophanes melanolophus*.—The Crested Black Tit is common throughout the district.

69. *Garrulax leucolophus*.—Tolerably common in the lower hills.

76. *Garrulax albigularis*.—The White-throated Laughing-Thrush is very common. One of its notes is a regular hiss—like a snake rather than a bird. It is an inquisitive bird, and as a rule not at all shy. My Scottish terrier was an object of great interest to this and other kinds of Laughing-Thrushes. Though they never actually mobbed it, as Drongos and Mynas often do, they often followed the dog for some distance through the jungle. I saw about twenty birds of this species following a marten (*Mustela flavigula*) in the same way.

82. *Trochalopteryx erythrocephala*.—This is such a skulker that it appears to be much rarer than it probably is. The stomach of one I shot was full of small snails.

90. *Trochalopteryx variegata*.—Fairly common. It has the usual habits of the Laughing-Thrushes; is very noisy, and goes about in small troops among scattered bushes and thin jungle.

99. *Trochalopteryx lineata*.—Very common indeed. It has a tri-syllabic call, preceded by a low trill: the latter is not heard, unless one is very close to the bird.

125. *Pomatorhinus ruficollis*.—Another inveterate skulker in thick undergrowth: I never saw more than three birds together.

174. *Stachyridopsis pyrrhops*.—In thick jungle; not often seen.

187. *Myiophonus temminckii*.—Common everywhere near running water, from the lowest valleys to above the snows. It is a thirsty bird, and very fond of bathing.

204. *Lioptila capistrata*.—The Black-headed Sibia is very common, especially on the edge of forest. It has a very loud, shrill song, which it sings perched upon some conspicuous branch. Besides this it has a variety of very harsh notes. Out of six specimens that I collected I find that the back and scapulars of one (a young male) are almost concolorous with the lower plumage, which is much duller rufous than in the others.

221. *Siva cyanoptera*.—I saw and shot the Blue-winged Siva a few miles from Almora, where it was common. I did not notice it elsewhere.

226. *Zosterops palpebrosa*.—I did not see this White-eye in Garhwal: it was common in parts of the Almora district.

232. *Ixulus flavicollis*.—A retiring bird, seen among thick undergrowth, in tree jungle.

249. *Ohloropsis hardwickii*.—Not seen in Garhwal: locally common in the Almora district.

261. *Psaroglossa spiloptera*.—Mr. Oates separates this bird from the Starlings, and he is no doubt right. All the same its habits are very like those of Mynas, except that it is never seen on the ground. It is very noisy and flies about in flocks. It has a very harsh call-note. A young bird had brownish irides.

269. *Hypsipetes psaroides*.—Very common at moderate elevations. It has many different, mostly harsh, notes. One of them is like the "mew" of a young kitten.

283. *Molpastes intermedius*.

284. *Molpastes leucogenys*.—This and *M. intermedius* are the common Bulbuls of Kumaon: they do not occur much above 6,000 feet.

315. *Sitta himalayensis*.—Very common and generally distributed. It is a wonderful tree climber, and progresses with equal ease, vertically, upwards, or downwards.

316. *Sitta cinnamomeiventris*.—Replaces *S. himalayensis* at the lower elevations: very common at Naini Tal.

325. *Sitta frontalis*.—I obtained only one specimen in the Almora district.

328. *Dicrurus longicaudatus*.—The Ashy Drongo is very common throughout the district. The iris in young birds is dark brown.

341. *Certhia himalayana*.—Common everywhere. It has a rapidly repeated note, which is very loud for such a small bird.

343. *Certhia nepalensis*.—I obtained one specimen, a male, near Yoshimath, Garhwal, on June 6th. The testes were so large that it was probably breeding then. This Tree-Creeper does not appear to have been previously recorded west of Nepal.

382. *Franklinia gracilis*.—Franklin's Wren-Warbler was common at moderate elevations.

405. *Phylloscopus affinis*.—Tickell's Willow-Warbler was very common and breeding in Garhwal, above 8,000 feet: it has a loud song.

418. *Phylloscopus humii*.—I am uncertain whether a Willow-Warbler that I obtained should be referred to *P. superciliosus* or to *P. humii*: the coronal band is certainly quite distinct, and, therefore, according to "The Fauna Brit. Ind., Birds," vol. i, page 410, more resembles *P. superciliosus*. On the other hand, the second primary is intermediate in length between the eighth and ninth, and the bird should therefore be *P. humii* (loc. cit., p. 411). According to the geographical distribution given by Mr. Oates, it is more likely to be *P. humii*. Even with the help of Mr. Brooks's paper in Str. Feath., vol. vii, on the subject, the identification remains undecided in my mind.

422. *Acanthopneuste viridanus*.—Common.

428. *Acanthopneuste occipitalis*.—Another common species at rather

high elevations: evidently breeding at about 10,000 feet, at the end of May.

434. *Cryptolopha xanthoschista*.—Hodgson's Grey-headed Fly-catcher-Warbler is common everywhere.

458. *Suya crinigera*.—Common throughout the district. It has an agreeable, but weak song; also a "chiff-chaff"-like call, repeated several times in quick succession.

475. *Lanius nigriceps*.—Common in the east of the Almora district, especially about Pithoragarh; not seen in Garhwal.

476. *Lanius erythronotus*.—Common up to about 7,000 feet.

495. *Pericrocotus brevirostris*.—This was the only Minivet I saw; it is generally distributed.

505. *Campophaga melanoschista*.—I procured specimens and saw this bird almost throughout the whole district.

518. *Oriolus kundoo*.—Common in many of the lower valleys.

538. *Sturnia malabarica*.—I only saw this bird once; near Almora.

549. *Acridotheres tristis*.—Common in the Almora district: only noticed at Chamoli, in Garhwal, where it was apparently breeding in holes in the cliffs, in company with *Cypselus melba* and *C. affinis*.

558. *Hemichelidon sibirica*.—I got some specimens near Niti, at about 10,000 feet; I did not notice it elsewhere.

568. *Cyornis superciliaris*.—Common.

579. *Stoparola melanops*.—Very common at low elevations.

592. *Culicicapa ceylonensis*.—Common.

595. *Niltava macgrigorise*.—The Small Niltava is met with among low thick undergrowth in the more open, low-lying valleys of Garhwal.

598. *Tersiphone paradisi*.—The "Ribbon-bird" is common in the lower parts of the district.

603. *Chelidorhynch hypoxanthum*.—Common, especially in the higher forests. It has the habit of opening its tail out fan-wise, as it hops about bushes.

608. *Pratincola caprata*.—Common.

610. *Pratincola maura*.—Common.

615. *Oreicola ferrea*.—The Dark-grey Bush-Chat is met with from the lowest valleys to nearly 11,000 feet. It was common, in May, about Niti, almost up to the snow line.

630. *Henicurus maculatus*.—Common on the lower streams and about small waterfalls. I saw a couple feeding in a flooded rice field at some distance from running water. It is rather shy and restless, and frequently perches on low bushes near the edge of a stream. The smallest brook suffices to attract this bird. By quietly approaching one of the many culverts that span small streams on the road between Naini



Tal and Almora, one was pretty sure to get a glimpse of a Forktail or two.

637. *Microcichla scouleri*.—I only saw the Little Forktail at one place, near Kedarnath, where it was very common. It has a short twittering song, which it sings in the intervals of searching under stones for food. It is remarkable to see such a frail little bird standing "knee deep" in the most rapid torrents.

638. *Chimarrhornis leucocephalus*.—Common throughout the valleys of Garhwal: it was especially numerous about Kedarnath and Badrinath, in May.

644. *Ruticilla rufiventris*.—This was the only Redstart that I saw, and that only near the Niti Pass. In the plains of India, in the cold weather, this is quite a tame, confiding bird, but I found it very wary in Garhwal, and had some difficulty in procuring a specimen. This, a male, shot on May 31st, had very large testes, and if not already breeding, would certainly have done so very soon. I had a long but fruitless search for nests of this species.

646. *Rhyacornis fuliginosus*.—Common about all the lower streams in Kumaon.

651. *Calliope pectoralis*.—I saw this bird at Mana and Niti in May. It has a long and pretty, though weak song. All that I shot were males. I noticed a plain-looking bird, perching on stones and low bushes, and rather shy: it was quite a surprise to me, on shooting one, to see the bright crimson throat.

654. *Ianthia rufilata*.—I only got one specimen, a hen, in Garhwal, in June.

663. *Copsychus saularis*.—Common at moderate elevations, throughout the whole of Kumaon.

672. *Merula albicincta*.—The White-collared Onzel is fairly common in Garhwal. It frequents rather open forest. Both male and female have white tips, as well as white shafts, to the under tail coverts. The margin of the eyelids is bright yellow.

676. *Merula bouboul*.—A common forest bird. It is one of the best songsters I know, and its loud and varied notes are a striking refutation of the old calumny that Indian birds "don't sing." It especially frequents the tops of high trees.

677. *Merula atrigularis*.—I only saw and obtained one specimen, at Dwarahath, Almora. It was feeding on wild cherries near the Dak Bungalow.

678. *Merula unicolor*.—Tickell's Onzel was not very common. I noted the following colours in a ♂, shot on June 26th, which, from the condition of its testes, must have been breeding—

Iris—Dark brown.

J. II. 21

Bill—Yellow throughout.

Tarsi—Greenish-yellow; feet, more yellow; claws, yellowish-horny.

683. *Geocichla wardi*.—Rather a retiring bird; met with only in moderately open forest.

690. *Petrophila erythrogastra*.—Not nearly so common as *P. cinclorhyncha*. "Rock-thrush" seems an inappropriate name for this bird in the Himalayas. I generally saw it perched near the top of a high tree.

691. *Petrophila cinclorhyncha*.—Very common at low elevations. The call-note is a single, rather loud whistle. The Blue-headed Rock-Thrush, like the last species, is often seen on high trees; it goes about in small parties of three or four individuals.

693. *Petrophila cyanus*.—Not very common, but still seen throughout most of the district. A male, shot near Niti, at about 10,200 feet, on May 30th, had testes about the size of peas.

695. *Turdus viscivorus*.—Common at high elevations in Garhwal, even above the snow. It is very pugnacious towards its own kind. I never heard it utter other than very loud, harsh notes.

701. *Oreocinclu mollissima*.—This bird is distinctly rare in Garhwal. I obtained one specimen near Yoshimath, among snow drifts at an altitude of about 13,000 feet.

704. *Zoothera monticola*.—I only met with the Large Brown Thrush in thick forest: it does not seem to be at all common. The claws of the anterior toes are white; that of the posterior dusky.

709. *Cinclus asiaticus*.—This was the only Dipper I obtained: it is very common.

727. *Uroloncha acuticauda*.—Hodgson's Munia is common in the lower valleys.

735. *Uroloncha punctulata*.—Common in the same localities as the last species.

746. *Pyrrhula erythrocephala*.—Frequents low ringall undergrowth in jungle; not at all shy.

755. *Propasser pulcherrimus*.—Very common about Mana and Niti, above 10,000 feet. It frequents low bushes, going about in considerable flocks. Although this is certainly a handsome bird, its specific name would be more appropriate to *P. rhodochrous*, which is a lovely bird in life.

758. *Propasser rhodochrous*.—Only noticed about Badrinath (10,284 feet). It was very common there in May; in the Mana and Niti districts it was replaced by the last species.

761. *Carpodacus erythrinus*.—Very common indeed in the lower valleys. Oates gives its range up to 10,000 feet, but I did not see it in Garhwal above 7,000 feet.

767. *Carduelis caniceps*.—I shot one, a ♂, out of a large flock, perched on a high fir tree, near Niti, at over 10,000 feet: this was the only occasion on which I saw this species.

771. *Metoponia pusilla*.—A common, familiar bird near Niti. The birds were sitting about, like sparrows, on the house tops of the village of Bampa, in May. Like sparrows, too, they roosted at night in large numbers on one or two particular trees, with the same noisy twittering as each batch of new-comers arrived and settled down for the night. The reproductive organs were in an advanced stage of development, and the bird must, I think, nest in the neighbourhood. The forehead and anterior portion of the crown are rather orange than crimson in my specimens.

772. *Hypacanthis spinoides*.—Common, up to 10,000 feet. It occurred in very large flocks at Ramni, in June (9,000 feet).

776. *Passer domesticus*.—Common about the hill stations and lower valleys. Yoshimath (6,000 feet) was the highest place in Garhwal where it was common.

780. *Passer cinnamomeus*.—This is the common Jungle-Sparrow in Kumaon: it is also found round the higher villages. Oates gives its range up to 7,000 feet, but I obtained specimens at Dungari, Garhwal, at well over 10,000 feet.

790. *Emberiza fucata*.—The Grey-headed Bunting is common throughout Garhwal.

794. *Emberiza stracheyi*.—Common up to 11,000 feet. It has a very soft, sibilant call-note; besides this, there is a long, disconnected sort of song.

803. *Melophus melanicterus*.—Common.

818. *Hirundo smithii*.—The Wire-tailed Swallow is generally distributed throughout the lower valleys.

822. *Hirundo nepalensis*.—Common.

826. *Motacilla alba*.—I shot a male, in full summer plumage, at Trijugi Narayan, Garhwal, on May 2nd. The testes were very small.

830. *Motacilla hodgsoni*.—Common towards the end of May, near Niti. It was very tame, and seems less restless than most Wagtails. I think that this species must breed in Garhwal, as the reproductive organs of those I shot were all fully developed. I was unable, however, to find any nests.

831. *Motacilla maderaspatensis*.—The only place at which I saw and procured the Large Pied Wagtail was at Bageswar, to the east of Almora. It was very common about the river there.

832. *Motacilla melanope*.—Common and probably breeding in the higher ranges. Reproductive organs very large in May and June.

840. *Anthus trivialis*.—I procured several specimens in April, but did not see the bird later in the summer.

841. *Anthus maculatus*.—I shot some of this species at 10,000 feet at the end of May. The sexual organs were still very small.

844. *Anthus similis*.—Not very common, and only seen at low elevations.

847. *Anthus rufulus*.—Bajjnath, in the Almora district, is the only place where I obtained this bird.

850. *Anthus vosaceus*.—Common on bare ground, at elevations of 10,000 feet and over. The day that I visited Kedarnath (May 4th) Hodgson's Pipit was in great force on the plain below the temple. It was a bitterly cold day and snowing hard, but the birds seemed quite cheerful. Its habits seem to be very similar to those of *A. pratensis*: it sings both on the wing and also when perched on some low bush or stone.

853. *Oreocorys sylvanus*.—The Upland Pipit is common on bare hill sides at moderate elevations. It has a very shrill call of two notes, frequently repeated, and soars, like a lark, to a height of twenty or thirty feet.

888. *Æthopyga gouldiæ*.—This Sun-bird was locally common, above 7,000 feet. At certain places, on a fine sunny day, one would notice numbers flitting about. On dull, overcast days one scarcely ever sees them.

890. *Æthopyga saturata*.—Rather less common than the preceding species.

946. *Gecinus squamatus*.—Very common in all well-wooded parts. I shot one specimen at above 11,000 feet. Like all the genus, it feeds a great deal on the ground. Small black ants are a very favourite food; the Woodpecker stands by the side of the ants' run, and picks them off as they come along. The bird also diligently hunts the rhododendrons.

950. *Gecinus occipitalis*.—Met with at moderate elevations, but it is, I think, nowhere very common.

951. *Gecinus chlorophus*.—I only obtained one specimen in Garhwal of this species.

960. *Hypopicus hyperythrus*.—Very common indeed throughout the entire district, wherever there are trees. It has a very loud, harsh note, and taps the trees rapidly, making a loud rattle. The bill is pale yellow beneath.

961. *Dendrocopus himalayensis*.—The Western Himalayan Pied Woodpecker is also very common. It has a loud "clucking" note, and seems partial to very rotten trees: it feeds a great deal on the ground.

969. *Dendrocopus auriceps*.—Fairly common at moderate elevations.

974. *Iyngipicus pygmæus*.—I only procured this bird once, near Almora.

992. *Chrysocolaptes gutticristatus*.—Tickell's Golden-backed Woodpecker is not uncommon in the lower valleys of the eastern part of the Almora Division: I did not see it in Garhwal.

1006. *Megalæma marshallorum*.—Very common all over Kumaon, up to about 8,000 feet. I found this Barbet very wary indeed, and it was by no means easy to procure specimens. To start with, it is rather difficult to locate the particular tree from which the noisy chorus is proceeding. The Barbets keep a sharp look-out, and most of my attempts at stalking them ended in failure. However, the flocks seem to be very regular in their movements, frequenting a given tree at almost exactly the same time every day, as long as the fruit on it lasts. I obtained several specimens by taking up a position under a tree a little before the time that I had seen the birds the day before. They almost always kept the "appointment," and I got an easy shot.

1012. *Cyanops asiatica*.—Common in the low-lying valleys of the eastern part of Kumaon. I did not see or hear the bird in Garhwal.

1025. *Eurystomus orientalis*.—I got one specimen in Kumaon at an elevation of 4,000 feet. This was the only occasion on which I saw this bird.

1034. *Ceryle lugubris*.—The Himalayan Pied Kingfisher is common at moderate altitudes. It wanders about a good deal forsaking a stream as soon as the water gets at all thick. It is usually found in pairs and is rather wary. It perches indifferently on stones or branches.

1035. *Alcedo ispida*.—Not at all uncommon on the lower streams, both in Garhwal and in the Almora district. I only shot one specimen, at Bageswar. This, a male, has a shorter bill than my specimens from other parts of India, the distance from the gape being only 1.7".

1067. *Upupa indica*.—Common up to about 6000 feet.

1068. *Cypselus melba*.—I saw two breeding places of the Alpine Swift in Garhwal; both on the Alaknanda river. They were quite inaccessible, being situated in high perpendicular cliffs at a considerable elevation above the river.

1072. *Cypselus leuconyx*.—At moderate elevations. This bird does not fly very fast, for a Swift. Two of my specimens, both hens, measure 6.8"; the wing of one being 6.5", and of the other 6.55", thus approaching the dimensions of *C. pacificus*. The feet of both were pale coloured and the claws almost black.

1073. *Cypselus affinis*.—Not seen above about 6000 feet.

1095. *Caprimulgus indicus*.—This was the only Nightjar I obtained in Garhwal: it is common.

1104. *Cuculus canorus*.—Very common.

1105. *Cuculus saturatus*.—Also common. I often heard the call of what I believed to be *C. poliocephalus*, but I obtained no specimens.

1107. *Cuculus micropterus*.—Very common. Its call notes are often heard on moonlight nights. It has a harsh alarm note, like "jüg-jüg-jüg," frequently repeated.

1118. *Coccytes jacobinus*.—I shot one specimen, in the Almora district, at about 6000 feet, at the end of June.

1141. *Pulsornis schisticeps*.—Very common indeed. I shot one bird in Garhwal, at 11,000 feet, in June.

1160. *Syrnium indrani*.

1184. *Glauucidium radiatum*.—These were the only two Owls that I procured, though I saw at least two other species that I was unable to identify.

1193. *Gyps himalayensis*.—I saw this fine Vulture on several occasions. There were five or six sitting on the rocks above Bampa, near the Niti Pass. They were not at all shy and allowed me to approach within thirty yards of them.

1199. *Gypaëtus barbatus*.—The Lämmergeyer is common, but the percentage of birds in fully adult plumage is very small.

1217. *Spilornis cheela*.—The Crested Serpent-Eagle is common, near running water, up to 6000 feet. It is very tame and has a loud cry.

1229. *Milvus govinda*.—The Common Pariah Kite is met with up to considerable elevations, wherever the country is open. I did not see *M. melanotis*, although constantly on the look out for it.

1248. *Accipiter virgatus*.—Fairly common.

1260. *Falco subbuteo*.—I saw either this species or *F. severus* many times, but could not procure a specimen.

1265. *Tinnunculus alaudarius*.—Very common.

1283. *Sphenocercus sphenurus*.—The Kokla Green Pigeon is very common. It has prolonged rather mournful notes, and a very swift and powerful flight. I saw one bird hanging almost head downwards from a slender branch, in a most un-pigeon-like attitude, as it attempted to reach some food. As I was within four yards of the bird, and watched it for some minutes, I am quite sure that I identified it correctly.

1292. *Columba intermedia*.—Common in cultivated districts, at moderate elevations.

1294. *Columba rupestris*.—I only saw the Blue Hill Pigeon at Badrinath, Garhwal. A few were feeding in company with *C. leuconota*. A hen bird, that I shot, had the irides orange, with a narrow inner circle of yellow. On May 20th, the ova were of the size of peas.

1296. *Columba leuconota*.—Very common at and above the snow-level, and not at all wild. They frequent the hill paths and the banks of streams, during the middle of the day, in pairs, or parties of three or four individuals. In the morning and evening they assemble in flocks of twenty to sixty birds and feed in the fields. I saw one of their breeding places at Mann, at the foot of the pass, on May 20th. It was in a cliff about eighty feet high, overhanging a cascade. The natives told me that the Snow-Pigeon always builds rather low down, near the water, to avoid the Choughs, which mostly frequent the higher parts of the cliff. I do not think that there were any eggs laid on the date of my visit, but I saw one bird carrying building materials to a ledge in the rock, and many courting, the males behaving just like domestic pigeons. I also saw one pair *in coitu*.

1297. *Dendrotreron hodgsoni*.—I saw this very handsome Wood Pigeon on several occasions, during the month of May, at about 7000 feet. Blanford says about this bird :—"A shy bird, usually seen in small flocks amongst the pine forests." I shot a pair at Gorikund, near Kedarnath, on May 2nd. They were feeding on low bushes, about thirty yards from my tent, and about fifty yards from the village, which was crowded with noisy pilgrims. They did not seem to be at all shy. I shot the hen first; the cock flew away for a short distance, and returned almost at once to the spot from which he had been disturbed. The reproductive organs were well developed, and the birds must soon have bred. I could get no information from the natives about their nidification. The claws are very bright yellow—not "pale yellow" as stated by Jerdon.

1305. *Turtur ferrago*.—The Indian Turtle Dove is common, and met with up to 10,000 feet.

1307. *Turtur suratensis*.—Very common, up to about 8000 feet.

1310. *Turtur risorius*.—Common at low elevations.

1333. *Catreus wallichi*.—I did not see the Cheer Pheasant myself, but I bought a skin said to have been obtained near Ranikhet.

1334. *Pucrasia macrolopha*.—Met with singly or in pairs in many parts of the district. At the time of my visit to Kumaon, all the pheasants were breeding, and I disturbed them as little as possible.

1336. *Gennæus albicristatus*.—Very common. I saw a cock clapping his wings and making a great demonstration in front of an apparently indifferent hen.

1342. *Lophophorus refulgens*.—Tolerably plentiful, and very wary.

1344. *Tragopan satyra*.—I did not come across this pheasant, but I bought a skin from a native. The bird was said to have been shot near the Pindari Glacier.

1372. *Francolinus vulgaris*.—Very common up to 7000. I heard a cock calling at Ramni, Garhwal (about 9000 feet), just above the limit of cultivation.

1462. *Totanus ochropus*.—I shot a Green Sandpiper in summer plumage, and saw a few others, at Adabadri, Garhwal, on April 20th. A few days later they disappeared.

XII.—Noviciæ Indicæ XVII. *Some new plants from Eastern India.*—  
By D. PRAIN.

[Received 11th June; Read 4th July, 1900.]

In this paper are contained descriptions of twelve previously undescribed species of plants from the north-eastern frontiers of India. A considerable number of these have been examined and compared at the Kew Herbarium by Sir George King, who has kindly undertaken, for some of them, the responsibility of joint authorship. The descriptions are, as usual, drawn up in such a way as to conform to the descriptions given in Sir J. D. Hooker's *Flora of British India*.

TILIACEÆ.

1. GREWIA (*Eugrewia*) *NAGENSII* Prain; shrubby, leaves scabrous, ovate-lanceolate, acuminate, finely subequally serrate; cymes axillary, peduncled; buds obovate, striate; drupe 2- or 1-lobed, subtesselately rugose with lenticular swellings, each crowned by a stellate hair.

ASSAM; Eastern Naga Hills at Narazu, *J. W. Masters* 1263! Teock Ghat near Tingali Bam, *Prain's Collector* 128! 262! Margarita, *Prain's Collector*!

Young shoots scabrous with stellate hairs; branches terete, sparsely stellately hairy. Leaves rather thick, 4·6 in. long, 2·5 in. wide, base rounded, 3-nerved, central nerve with 3-4 pairs of slightly arching nerves, sparsely stellately hairy above, rather densely stellately hairy, especially in the nerves, beneath; stipules subulate as long as the petioles. Cymes axillary, umbellate, few-flowered, peduncles 3-5 in. long, pedicels as long, in fruit elongate and reaching 6 in., bracts triangular-lanceolate, 2 in. long, stellate-hairy outside, striate within. Buds 25 in. long, 2 in. wide. Sepals 4 in. long, lanceolate. Petals linear, 3 in. long. Torus densely adpressed-rusty-tomentose, 15 in. long, cylindric. Drupe with 1 or 2 orbicular lobes, 3 in. long and broad and 25 in. thick.

The Calcutta Native Collector describes the flowers as yellow. The leaves most nearly resemble those of the Burmese species *G. microstemma*; the margins are, however, more finely toothed. The flowers are quite unlike those of *G. microstemma* and most closely resemble those of *G. oppositifolia*, but the torus is very considerably



longer than in that species. The fruits afford the most distinctive character; they approach most nearly to, though they are still widely different from, those of *G. umbellifera* Bedd. (*G. capitata* Dalz.), next to which species the systematic position of the present one is.

#### OLACINÆÆ.

2. *GOMPHANDRA SERRATA* King & Prain; leaves serrate, ovate or ovate-lanceolate, cymes axillary or also from leaf-scars lower down, rather longer than the petioles.

KACHIN HILLS; Myitkyina, Prain's Collector!

A small tree, everywhere glabrous. Leaves chartaceous, glandular-serrate except at the cuneate base, apex acute, nerves about 9 pairs, prominent beneath; length usually about 6 in., breadth 2-3 in.; petiole ½ in. Cymes finely puberulous. Calyx minute, 4-5-toothed. Corolla and stamens not seen. Fruit ½ in. long, ovate, narrowed gradually to an acute tip, dark-brown, smooth, crowned by the remains of the stigma, pericarp thin, firmly coriaceous, the inner layer almost woody. Seed large, testa pale, thin.

Very different from any of the other species of *Gomphandra* either in Herb. Kew or Herb. Calcutta.

#### COMBRETACEÆ.

3. *COMBRETUM KACHINENSE* King & Prain; leaves ovate-lanceolate, caudate, glabrous above, finely rusty-pubescent beneath, only subopposite; flowers in axillary, simple or sparingly branched, almost spicate lax racemes; calyx not constricted above the ovary, densely rusty outside, glabrous within.

KACHIN HILLS; near Sima, Prain's Collector!

A large scandent shrub, without thorns; branches densely rusty-pubescent. Leaves subopposite, 8-9 in. long, 2½-3 in. wide, chartaceous, caudate apex ½-¾ in. long, margin entire, base abruptly cuneate or almost rounded; petiole densely rusty, ½ in. long, stipules subulate ¼ in. long, subsistent. Racemes 3-4 in. long, branches if present few, 1-1½ in. long, rachis densely rusty; bracteoles minute, rusty. Flowers subsessile. Calyx campanulate, 5-lobed, densely rusty externally throughout, ½ in. long, lobes ovate-acute, glabrous within. Petals narrow obovate, exceeding the calyx, ½ in. long, glabrous. Stamens 10, those of the antipetalous series with short but distinct filaments and lanceolate anthers, the others with short broad oblong anthers subsessile. Ovary sessile, quite glabrous, gradually narrowed into the glabrous simple style.

A very distinct species unlike any of the 5-merous Indian species. Among Indian *Combreta* it most resembles *C. dasystachyum* Kurz, which has however 4-merous flowers. In foliage it very closely resembles *Combretum ferrugineum* Schimper, from Abyssinia.

#### OLEACEÆ.

4. *JASMINUM EXCELLENS* King & Prain; glabrous; leaves opposite pinnately 7-foliolate, less often 5-foliolate or occasionally close to the

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inflorescence 3-foliolate, leaflets cordate- or ovate-lanceolate, glabrous, sub-3-nerved; *cymes* axillary lax; *calyx-teeth* short; *corolla* white, tube .8 in. long.

KACHIN HILLS; Shan Busti, Sadon, 5000 ft., *Prain's Collector* !

An extensive climber. *Terminal* leaflet 2-2.5 in. long, .5-.75 in. wide, lateral nearly as wide, usually 3, less often 2 pairs, only 1.25-1.5 in. long. *Cymes* 10-14-flowered, bracts subulate .2-.25 in. long, pedicels .5-1.25 in., slender. *Calyx* glabrous, teeth subulate .1 in. long, as long as the tube. *Corolla* white, lobes elliptic, subacute, .5 in. long, .25-.3 in. wide. *Fruit* not seen.

Neither in the Kew Herbarium nor in that of Calcutta can we find anything like this very handsome Jasmine. The inflorescence reminds one most of that of *J. dispersum*, when its *cymes* are axillary, but the long slender pedicels, the calyx, and the leaves are very different. The species comes nearest *J. officinale* Linn., but again the calyx-teeth are different, being in our plant much shorter, while the *cymes* are axillary not terminal, and the pedicels are longer than in *J. officinale*.

#### ASCLEPIADACEÆ.

5. *MARSDENIA* (*Eumarsdenia*) *LEIOCARPA* King & Prain; quite glabrous except the finely puberulous rachis and pedicels; *leaves* ovate-lanceolate or ovate caudate-acuminate, base rounded or cuneate; *flowers* in rather lax axillary racemes; *follicles* quite glabrous.

KACHIN HILLS; between Myitkynia and Sadon, *Prain's Collector* !

A large climber; *stem* stout, smooth as are the branches, petioles and leaves on both surfaces from a very early stage; the youngest leaves very finely deciduously laxly puberulous. *Leaves* 3-6 in. by 1-3 in., nerves spreading, rather prominent beneath, 5-8 pairs, glandular above at the petiole; petiole .75-1.25 in. long. *Racemes* 4-6 in. long, lower portion of axillary rachis 1-2 in. long, uniform and glabrous (peduncle-like), the rest puberulous, slightly zig-zag, with small tumid minutely scaly and pubescent nodes in the retiring angles, about .3 in. apart below, approximate above. *Flowers* at the nodes usually solitary, sometimes germinate, rarely more, on puberulous slender pedicels .25 in. long. *Sepals* suborbicular, nearly glabrous, with faintly hyaline margins. *Corolla* not seen. *Follicles*, only one of a pair developed, when quite ripe 1.6 in. long, .15 in. in diam., lanceolate, rather abruptly narrowed at the base, coriaceous, quite glabrous in the very youngest stage. *Seeds* narrowly ovoid, .25 in. long.

Very nearly related to *M. tinctoria* E. Br., and *M. eriocarpa* Hook. f., but extremely distinct on account of its much smaller, quite glabrous follicles, and smaller seeds.

6. *CEROPEGIA KACHINENSIS* Prain; *leaves* slightly puberulous above and on margins, glabrous glaucous beneath, long petioled, ovate acuminate base rounded; *corolla*-lobes subspathulate half as long as the slightly curved tube, their apices ciliate and connate so as to form a conical crown over the not greatly dilated throat; *coronal* lobes 10, triangular, ciliate, less than half as long as the linear, slightly clavate,

straight processes. *C. pubescens* Prain in *Rec. Bot. Surv. Ind.* i, 252 not of Wall.

KACHIN HILLS; Myitkyina, Prain's Collector!

A slender climber with glabrous stems, branches, peduncles and pedicels. *Leaves* 3-3.5 in. by 1.5-1.75 in.; *petioles* .6-.75 in. *Peduncles* rather slender, as long as *petioles*, 8-12-fld., *pedicels* .5-.6 in. slender. *Calyx*-segments lanceolate their tips pinkish, glabrous, .2 in. long. *Corolla* slightly curved, 1.25 in. long, base slightly inflated, upper third of tube somewhat abruptly funnel-shaped; tube pale green with small purple spots in upper third and with pinkish lines below; lobes green in lower, yellow in upper half and the margins there purple-ciliate. *Follicles* slender, spreading horizontally, each 4 in. long, .25 in. in diam., greenish with irregular red streaks. *Seeds* about 20 in each follicle, narrow ovate, compressed, .4 in. long, .12 in. wide, coma white, nearly twice as long as seeds.

Erroneously distributed in 1898 under the name *C. pubescens*, this is to be found in various collections. The species is perhaps most nearly related to *C. Thuaitesii* Hook., from Ceylon, but is abundantly distinct. The present description is drawn up from living specimens which have flowered in the Royal Botanic Garden, Calcutta.

#### ACANTHACEÆ.

7. *GYMNOSTACHYUM* (*Cryptophragmium*) *LISTERI* Prain; minutely puberulous; *leaves* large, short-petioled, oblanceolate; *panicles* mostly lateral, many-flowered; *corolla* .75 in. long.

CHITTAGONG; Demagiri, in rocky places, Lister 162!

A small undershrub, under a foot high. *Leaves* attaining 8 in. by 3 in., widest at the junction of the anterior and middle third, acute or acuminate, tapering gradually in the basal half to a petiole .5-.75 in. long, margins entire, veins slightly arched forward, 12-14 pairs, minutely puberulous on both surfaces. *Panicles* chiefly from the axils of the lower leaves and the leaf-scars below these, 1.5-2.5 in. long, branches subspicate; flowers solitary or clustered; bracts small, linear. *Sepals* .2 in., linear. *Corolla* puberulous. *Anthers* linear-oblong. *Capsule* .5 in., very narrow, glabrate. *Seeds* ovoid, compressed.

Very closely related to *Gymnostachyum latifolium* T. And. (*Cryptophragmium latifolium* Dalz.), and with that species standing, as regards habit, rather distinctly apart from the other Indian *Gymnostachya*. It is, however, very distinct from *G. latifolium* on account of its differently shaped leaves, its shorter flowers with different anthers, and its much smaller capsules. We are indebted to Mr. C. B. Clarke, for having very kindly compared our specimens with the material preserved in the Herbarium at Kew.

8. *PERISTROPHE LONGIFOLIA* King & Prain; *leaves* distinctly petioled, lanceolate, glabrous except for some adpressed hairs on midrib above and below; *bracts* lanceolate, faintly puberulous; *corolla* pink, 1.25 in. long.

KACHIN HILLS; Sadon, Prain's Collector! EASTERN NAGA HILLS; near Baliijan, Prain's Collector!

*Leaves* 4-6 in. long, .75-1 in. wide, margin undulate, gradually tapering from junction of middle and lower third to apex and to a slender petiole .75 in. long; raphides very slender plentiful on both surfaces. *Bracts* .75 in. long, .25 in. wide, acute. *Filaments* sparsely pubescent; anther-cells linear, one superposed for half its length.

This is very like a plant at Kew from Ichang, (Henry n. 4158) as regards foliage, but the Ichang plant has broader bracts than the Kachin one though it has a similar condensed inflorescence. *Hypoestes salicifolia* O. Kuntze, represented at Kew by a flowerless scrap, named by its author, resembles our plant in leaves, inflorescence and bracts without however quite agreeing with it absolutely in these characters. Our plant has however the two-celled anthers that distinguish *Peristrophe* from *Hypoestes*. Henry's n. 4158 from Ichang, at Calcutta, differs considerably from our plant.

### LABIATÆ.

9. *GOMPHOSTEMMA* (*Pogosiphon*) *INOPINATUM* Prain; ascending, leafy stems and flowering scapes distinct; leaves distinctly petioled; spikes erect, not interrupted even at the base.

KACHIN HILLS; Langkon, 3000 ft. elev., Prain's Collector!

*Stems* ascending, rooting below, 4-grooved, and with rounded angles, several from a woody rootstock with numerous tufted, woody, branching, slender roots; about a foot high; densely clothed with a close, ash-grey, stellate tomentum, intermixed with a copious pubescence of laxly spreading, long, white hairs. *Leaves* 4-6 pairs, the lowest small, the pairs 3-4 in. apart; petioles 1-1.5 in. (occasionally about 2 in.) long, pubescent like the stems but with fewer long, lax, white hairs in proportion to the stellate pubescence; lamina broadly ovate-acute, 3-5 in. long by 1.75-3 in. wide, the base of lower leaves slightly cuneate, of the upper rounded; margin finely crenate except at the basal fifth; nerves about 6 pairs, ascending; upper surface finely velvety with a soft, ash-grey, stellate pubescence interspersed with longer, simple, subadpressed tomentum, under surface softly velvety with a felted, whitish-grey, stellate pubescence. *Flowers* densely whorled, in radical spikes 2 in. long, 1.25 in. wide, on erect peduncles 3-6 in. long, with sometimes a pair of small foliaceous opposite bracts about .25 below the spike; peduncles with pubescence exactly as on the stem, but themselves terete and more slender; floral bracts obovate, dentate, sparsely stellate-pubescent tinged with pink, the lowest .5 in. long, .25 in. wide. *Calyx* wide-campanulate, glabrous within, tube rather closely stellate externally, limb with 5 equal, wide-triangular claret or purple lobes, sparsely stellate on the strongish central and weaker marginal nerves; .5 in. long, .3 in. wide, the lobes .2 in. long; bracteoles obovate-lanceolate .2-.25 in. long, reddish. *Corolla* .75 in. long, upper lip subentire, lower 3-lobed with slightly emarginate mid-lobe and inflated throat, apparently annulate within. *Stamens* exerted, filaments hirsute at their insertion. *Ovary* and style glabrous. *Nutlets* usually 4, sometimes 2-3, reddish, quite glabrous, wall very thickly coriaceous when dry.

Only one of our specimens had a few rather shrivelled corollas, from two of these, unsoaked as carefully as possible, the above description is given. Their colour is not particularly noted by the native collector, who simply remarks "flowers red," with reference doubtless to the purple or claret-coloured calyx. Further examination of less advanced specimens will be required in order to confirm the

existence of a distinct annulus. Its other characters however amply justify its title to specific rank. It is not very like any of the hitherto described Indian *Gomphostemma*. The fact that the flowers occur on independent leafless stems or scapes recalls the habit of *G. chinense* Oliv. and the fact that the calyx and less markedly the bracteoles are purple-coloured, recalls also *G. Curtisii*, and *G. pedunculatum* which are the other members of the group *Pedunculata* to which *G. chinense* belongs. The general facies of the species nevertheless rather recalls the *Strobilina* group of the § *Pogoniphon* to which, from the presence of hairs within the corolla tube, it must necessarily be referred. If, however, we are right in supposing that these hairs form a distinct annulus, instead of being scattered as in the other *Strobilina*, it must be considered in this respect as linking that group with the hitherto somewhat isolated *G. Hemsleyanum*.

This is the second new species recorded since the publication by the writer in 1891 of *An account of the Genus Gomphostemma* (Ann. Roy. Bot. Gard., Calcutta, iii. 227, et seq.). The other species, *Gomphostemma furfuracea* Hallier fl., has been very fully and accurately described and figured by its author, after comparison with the material in the Calcutta Herbarium, in *Bull. de l'herbier Boissier* vi. 351, 622 t. 9, f. 1 a-c (1898). It is a species of § *Eugomphostemma*, group *Melissifolia*, and as its bracts are not longer than the calyx it comes nearest to *G. velutinum* and *G. Mastersii*. The outer bracts are however in shape like those of *G. ovatum* and *G. melissifolium*, so that it stands, as its author has already indicated, intermediate between *G. ovatum* and *G. Mastersii*. It is a native of Eastern Sumatra.

Another point with reference to this genus may be noted in passing. In the account of the genus referred to above, the position of *Gomphostemma flavescens* Miq. was left doubtful. In the following year the writer was able to say that, judging from specimens of the plant (*Anthoocoma flavescens* Zoll.) on which Miquel's species is based, kindly lent by Dr. Treub from the Buitenzorg Herbarium, this species was in reality *Cymaria acuminata* DCne. In 1895 the writer was afforded, through the kindness of M. Drake del Castillo, an opportunity of examining the actual type specimen of *Anthoocoma flavescens* and of thus confirming the accuracy of the identification published in *Annals of Botany* vi. 214 (1892).

## CHLORANTHACEÆ.

10. *CHLORANTHUS KACHINENSIS* King & Prain; leaves subsessile, ovate, caudate-acuminate, margin finely gland-serrate except at the crenate base; anthers 3, connate by their connective; spikes in terminal clusters.

KACHIN HILLS; Shan Busti, Sadon, near water, Prain's Collector!

An evergreen erect undershrub; leaves glabrous, shining above, dull and finely puberulous on the nerves beneath, nerves about 10 pairs doubly inarched within the margin, length 6-8 in., breadth 3-3.5 in., caudate apex .75-1 in. long; petiole 1 in. long or 0. Spikes 3.5 in. long, 4-6 together, fascicled at the apex of the branches among linear bracts, surrounded by 2 closely approximated, distichous pairs of leaves.

The leaves most resemble those of *C. officinalis* Bl., but the fascicled instead of panicle spikes at once distinguish it. The inflorescence is like that of *C. nervosus* Coll. & Hemsl., from the Shan Plateau, which is however at once distinguished by its coarsely serrate, distinctly petioled and smaller leaves which are not caudate-acuminate at the apex.

## LILIACEÆ.

11. *SMILAX* (*Eusmilax*) *POTTINGERI* Prain; branches terete, smooth or with few minute black verrucæ; leaves 6–8 in. by 4·5–5·5 in., ovate abruptly acuminate, the narrow tip ·6 in. long, thinly subcoriaceous or chartaceous, very dark green above, glaucescent beneath, 5-costate from the slightly cordate base, petiole 1·5 in., the basal portion ·6 in. long, narrowly sheathing; peduncles solitary, axillary, 3·5–4 in. long, very slender, rigidly wiry, terete, smooth, 25–30-flowered; pedicels rigid, slender, grooved, ·5–·6 in. long. *S. macrophylla* Prain in *Rec. Bot. Surv. Ind.* i. 275 (not of Roxb.).

KACHIN HILLS; Myaungjong, Pottinger; near Sadon, Prain's Collector!

An extensive climber; leaves somewhat shining above, with strong secondary reticulations; between the main-nerve on both surfaces; cirrhi slender, wiry, 4–5 in. long, springing from apex of sheathing part of petiole. Peduncle springing from a swelling ·2 in. above the petiole, bracts 0, bracteoles at base of pedicels shortly oblong obtuse, pale-brown, palea-like, persistent, making a small globose head ·25 in. across. ♂ flowers not seen. ♀ Perianth segments ovate obtuse under ·2 in. long; staminodes 3, style short with 3 stout recurved stigmas. Fruit small ·25 in. diam.

A very distinct species coming nearest *S. ferox* and its allies, but not very closely related to any hitherto described Indian species.

## AROIDEÆ.

12. *CRYPTOCORYNE CRUDDASIANA* Prain; leaves linear-lanceolate; tube of spathe narrow, longer than the limb, limb of spathe lanceolate acute not twisted, distinctly rather distantly transversely plicate within.

KACHIN HILLS; Keju river, near Sima, Prain's Collector!

Tuberous, stoloniferous. Leaves 5–8 in. long, ·25–·3 in. wide, rather abruptly acute, lower fourth to third sheathing; midrib distinct. Scape very short. Tube of spathe 3 in. long, limb 1·25 in. long, lanceolate acuminate, purple within, with transverse folds, ·1 in. apart, crossing its whole inner surface.

A very distinct species, in habit much resembling a small form of *C. ciliata* Fisch., and in this respect unlike any other Indian species of the genus. Its spathe has, however, a limb that is rather longer and much narrower in proportion to the tube than that of *C. ciliata*, while there are no fimbriæ but, instead, there are numerous transverse rugæ as in *C. spiralis* Fisch., which has however different leaves, a twisted limb to the spathe, with a tube much shorter than the limb. This species has been very kindly compared with the material preserved in Herb. Kew by Sir George King and Mr. N. E. Brown.

XIII.—*A list of the Asiatic species of ORMOSIA.*—By D. PRAIN.

[Received 21st June; Read 4th July, 1900.]

On two previous occasions the writer has dealt with the genus *Ormosia* (N.O. *Leguminosæ*) in the *Society's Journal*.<sup>1</sup> The communication of three new forms from the Kachin Hills representing at least two new species, and the presence of two apparently undescribed forms among Chinese collections, renders it advisable to provide the requisite specific descriptions. It may therefore be as well to give at the same time a key to all the known Asiatic species as a preliminary to an exhaustive monograph of the genus.

According to Hooker and Jackson<sup>2</sup> the earliest name for the genus is *TOULICHIBA*<sup>3</sup> Adans.; as however, the name *ORMOSIA*<sup>4</sup> Jacks. is in familiar use it is convenient to retain it. Other generic names have been from time to time applied to one or more species of *Ormosia*. These are *LAYIA* Hook. and Arn.,<sup>5</sup> *CHENOLOBIMUM* Miq.,<sup>6</sup> and, in the writer's opinion, *ABILLARIA* Kurz.<sup>7</sup> To these Bentham has tentatively added *MACROTROPIS* DC.,<sup>8</sup> a genus founded by DeCandolle to include two plants from S. China and Cochin China that form the genus *Anagyris* Lour.<sup>9</sup> as opposed to the true *Anagyris* of Linnæus. This tentative reduction has been formally accepted in the *Index Kewensis* but it is not acceptable to the writer because the keel, Loureiro tells us, is in his two species longer than the standard; this is not the case in any known *Ormosia* and as neither of Loureiro's plants are known to modern students it is better to keep *Macrotropis* separate. These objections, however, do not apply to the reduction of *MACROTROPIS* Miq. (not of DC.).<sup>10</sup> In the first place Miquel in dealing with the two species which he referred to *Macrotropis* found it necessary to provide for their reception a new section *Amacrotropis*, characterised by having the standard as long as the other petals, that is to say Miquel had to abandon the character that is most distinctive of the true *Macrotropis* before he could accommodate his two species in the genus. In the second place there are authentic examples of both Miquel's plants in Herb. Calcutta and both are true *Ormosias*.

<sup>1</sup> J.A.S.B. lxxvi. 2, 146 and 467 (1897).<sup>2</sup> *Index Kewensis* ii. 367.<sup>3</sup> Adans. *Fam.* ii. 326 (1763).<sup>4</sup> Jackson in *Trans. Linn. Soc.* x. 360 (1811).<sup>5</sup> Hooker and Arnott, *Bot. Beech. Voy.* 183, t. 38 (1833).<sup>6</sup> Miquel, *Flor. Ind. Bat. Suppl.* 302 (1860).<sup>7</sup> Kurz, J.A.S.B. xlii. 2. 70 (1878).<sup>8</sup> DeCandolle, *Prodr.* ii. 98 (1825).<sup>9</sup> Loureiro, *Flor. Cochin-Chin.* 260 (1790).<sup>10</sup> Miquel, *Flor. Ind. Bat. Suppl.* 294 (1860).

ARILLARIA Kurz, has not been accepted as a valid genus by Baker<sup>1</sup> or by the editors of the *Index Kewensis*. The species on which it is founded was treated by Roxburgh,<sup>2</sup> who has left a coloured drawing of the plant in Herb. Calcutta, as a *Sophora*. Wight has reproduced this figure<sup>3</sup> and in discussing it has suggested that the plant is nearer to *Ormosia* than to *Sophora* but that, owing to its having a fleshy pod, it is perhaps a distinct genus. This genus he refrained from founding because the account given by Roxburgh of the arillus was not clear to him. Kurz has confirmed and amplified Roxburgh's account of the arillus and has therefore provided the generic description that Wight did not venture to give. Taubert has adopted Kurz's genus, though his attitude may require to be discounted to some extent, for he at the same time retains among the *Ormosias* the species on which *Arillaria* is based.<sup>4</sup> In spite of the views expressed by Wight, Kurz and Taubert the writer agrees with Baker and Baillon<sup>5</sup> in thinking that the species may quite well be accommodated in *Ormosia*, though he nevertheless thinks the characters of the species (*Ormosia robusta*) are such as to entitle it to the rank of a subgenus.

Bentham has, for convenience, divided the Brazilian species of the genus into two groups,<sup>6</sup> *Concolores* or species with the leaflets glabrous to the naked eye on both sides except perhaps, the midrib, and with the leaves not much paler beneath than above, and *Discolores* with the leaves paler beneath and there manifestly puberulous silky or tomentose. Baker has also, in essence, adopted this method of subdividing the genus and Taubert has even formally adopted Bentham's groups as sections and applied them to the whole genus. This subdivision, however, does not always permit species that are naturally closely related to remain together and it is not improbable that a classification which depends more on the characters derived from fruit and seed and less on characters obtained from the shade of green and the degree of tomentum of the leaves will in future be found more satisfactory.

Below a purely tentative scheme of classification is briefly sketched :—

Pod with woody valves; seeds scarlet with or without a black spot near the hilum not enveloped in an aril; Sub-gen. **TOULICHIA.**

Leaf-rachis bearing at its tip the distal pair of leaflets as well as the terminal leaflet; Sect. **CHENOLOBIUM.**

<sup>1</sup> Hooker, *Flor. Brit. Ind.* ii. 252 (1878).

<sup>2</sup> Roxburgh, *Hortus Bengalensis* 31 (1814).

<sup>3</sup> Wight, *Icones* t. 245 (1840).

<sup>4</sup> Engler *Naturlich. Pflanzenfam.* iii. 3. 194 (1894).

<sup>5</sup> Baillon, *Hist. des Plantes* ii. 362 (1869).

<sup>6</sup> Martius, *Flora Brasil.* xv. 1. 315 (1862).



Leaf-rachis prolonged beyond the distal pair of leaflets to support the terminal one; Sect. *ORMOSIA* proper.

Pods with thickly woody valves not septate between the large seeds which are usually solitary; Sub-sect. *Macrodisca*.

Pods with thickly woody valves septate between the small seeds which are usually several; Sub-sect. *Layia*.

Pods with thin woody valves and usually solitary always small seeds; Sub-sect. *Amacrotropis*.

Pod with fleshy valves; seeds black, enveloped in a fleshy arillus; Sub-gen. *ARILLARIA*.

The Asiatic species of which sufficiently complete material has been reported should be distributed as follows among these groups:—

### I. TOULICHIBA.

1. *CHENOLOBIUM*. *O. pachycarpa*, *O. venosa*, *O. decemjuga*, *O. septemjuga*, *O. polita*.
2. *ORMOSIA* proper.
  - (a) *Macrodisca*. *O. macrodisca*, *O. gracilis*, *O. travancorica*.
  - (b) *Layia*. *O. emarginata*, *O. Henryi*, *O. inopinata*, *O. laxa*, *O. glauca*, *O. Balansae*.
  - (c) *Amacrotropis*. *O. microsperma*, *O. parvifolia*, *O. sumatrana*, *O. yunnanensis*.

### II. ARILLARIA. *O. robusta*.

The other species given in the subjoined key, which is more or less artificial, at all events in detail, are species of which the fruit is not yet known. In the account of *Ormosia* given in the Society's *Journal*, 1897, a previously undescribed species was there named *O. nitida*. There is however, a prior *O. nitida* Vogel,<sup>1</sup> which stands good; it has therefore been necessary to rename the Malayan species.

#### *Key to the Asiatic species of Ormosia.*

Erect trees:—

Pod with fleshy valves; seeds with complete arillus;  
leaflets glabrous beneath ... .. 1. *robusta*.

Pod with woody valves:—

Seeds with a black adnate basal arillus, leaves minutely  
sparsely pubescent underneath:—

Panicles fastigiate, flowers white; pod 8 cm. wide;  
seed 2.5 cm. long ... .. 2. *macrodisca*.

Panicles lax, flowers yellow; pod 3 cm. wide; seed  
2 cm. long ... .. 3. *gracilis*.

<sup>1</sup> *Linnaea*, xi. 405 (1837).

- Seeds with a uniform pink testa and no arillus :—
- Leaflets beneath glabrous or only downy along the midrib :—
- Leaflets 3-5 :—
- Calyx glabrous; leaflets obovate-oblong obtuse or emarginate, base cuneate; stamens 9 ... 5. *emarginata.*
- Calyx pubescent; leaflets elliptic-oblong obtusely acuminate, base rounded; stamens 5 ... 4. *semicastrata.*
- Leaflets 7-9; base rounded; calyx pubescent :—
- Leaflets narrowly oblong; rachis prolonged beyond distal pair of leaflets :—
- Leaflets dark green gradually narrowed to an acute point ... .. 6. *calavensis.*
- Leaflets pale grey-green, caudate-acuminate :—
- Pod broadly oblong, 5-6 cm. long, 3.5 cm. wide, seeds large 2.5 cm. long ... .. 7. *travancorica.*
- Pod narrowly oblong, 5-7.5 cm. long, 3 cm. wide; seeds small 1 cm. long ... .. 8. *glauca.*
- Leaflets broadly oblong, apex rounded or shortly abruptly cuspidate; rachis bearing distal pair of leaflets, as well as the terminal leaflet, at its tip ... .. 18. *polita.*
- Leaflets beneath more or less persistently hirsute or velvety :—
- Leaflets with distinct petiolules and the leaf-rachis prolonged beyond the distal pair of leaflets :—
- Pod large with thickly woody flattened valves; pedicels long,  $\frac{1}{3}$ rd to quite as long as calyx :—
- Pods narrowly oblong, 6-7 cm. long, 2.25 cm. wide, seeds 1.25 cm. long or less :—
- Leaflets 7-9, thickly coriaceous, glabrous above, densely velvety beneath ... 9. *Henryi.*
- Leaflets 15-17, chartaceous, deciduously puberulous above, softly pubescent beneath 12. *lana.*
- Pods broadly oblong, 5-6 cm. long, 3.5 cm. wide; seeds 1.5 cm. long or longer; leaflets 7-11, rarely 5 :—
- Pod glabrous; racemes even in fruit much shorter than the leaves :—
- Corolla pink, leaflets persistently pubescent beneath ... .. 10. *inopinata.*
- Corolla yellow, leaflets glabrescent with age 10b. *inopinata*  
VAR. *dubia.*
- Pod pubescent; racemes in fruit as long as the leaves ... .. 11. *Balansae.*
- Pod small with thin woody convex valves, 1.5 cm. wide; pedicels less than half as long as calyx :—
- Leaflets small, 6 cm. long or shorter, 9-13, shortly acuminate ... .. 17. *parvifolia.*

- Leaflets large, 10 cm. long or longer :—  
 Leaflets thinly pubescent beneath; panicles  
 lax, bracts small :—  
 Leaflets 7-9, rarely 5, ovate, obovate or  
 elliptic, pale-green ... 14. *sumatrana.*  
 Leaflets 13, narrow oblong dark-green ... 15. *yunnanensis.*  
 Leaflets densely pubescent beneath, dark-  
 green 11-13; panicles fastigiate, bracts  
 conspicuous :—  
 Pod glabrous ... 16. *microsperma.*  
 Pod hirsute ... 16b. *microsperma*  
 VAR. *Bidleyi.*
- Leaflets with short petiolules or subsessile, leaf-rachis  
 bearing at its apex the distal pair of leaflets as  
 well as the terminal leaflet :—  
 Pod with thinly woody valves, 2-2.5 cm. wide :—  
 Leaflets 13-15, ovate-acute ... 19. *septemjuga.*  
 Leaflets 19-21, lanceolate acuminate ... 20. *decemjuga.*  
 Pod with thickly woody valves, 3.5 cm. wide; leaflets  
 ovate oblong :—  
 Leaflets abruptly shortly cuspidate; pod persis-  
 tently woolly ... 21. *pachycarpa.*  
 Leaflets obtuse or subobtuse; pod glabrous ... 22. *venosa.*  
 Climber; leaves glabrous beneath, dark green ... 13. *scandens.*

### ORMOSIA JACKS.

Subgenus 1. *ARILLARIA* Kurz (pro genere) *Journ. As. Soc. Beng.* xlii. 2. 71.

1. *ORMOSIA ROBUSTA* Baker in *Hook. fil. Flor. Brit. Ind.* ii. 252 (1878); *Taub. in Engl. Naturl. Pflanzenfam.* iii. 3, 194 (1894). *O. floribunda* Wall. *Cat.* 5337 (1832). *Sophora robusta* Roxb. *Hort. Beng.* 31 (1814); *Wight Icones* t. 245 (1840). *Arillaria robusta* Kurz *Journ. As. Soc. Beng.* xlii. 2. 71 (1873) and xlv. 2, 224 (1876) and *For. Flor. Brit. Burma* i. 334 (1877); *Taub. in Engl. Naturl. Pflanzenfam.* iii. 3. 196 (1894).

ASSAM; Brahmaputra Valley, near foot of Akha Hills, King's Collector! Silhet, Roxburgh (*l.c.* in *Herb., Calcutta*)! DeSilva (*Wall. Cat.* 5337)! CHITTAGONG; Kodala Hill, King's Collector! BURMA; Amherst, Falconer! Rangoon, Kurz! Pegu Yomah, Kurz!

Subgenus 2. *TOULICHIBA* Adans. (pro genere) *Fam.* ii. 326 (1763).

§ *EUORMOSIA.* *ORMOSIA* Jacks. (genus) *Trans. Linn. Soc.* x. 360 (1811).

¶ *MACRODISCA.*

2. *ORMOSIA MACRODISCA* Baker in *Hook. fil. Flor. Brit. Ind.* ii. 253 (1878); Prain, *Journ. As. Soc. Beng.* lxvi. 2. 148 and 467 (1897).

MALAYAN PENINSULA; Malacca, Maingay! Singapore, Ridley!

3. *ORMOSIA GRACILIS* Prain, *Journ. As. Soc. Beng.* lxvi. 2. 148 and 468 (1897).

MALAYAN PENINSULA; Perak, *Scortechini! Kunstler! Wray!*

4. *ORMOSIA SEMICASTRATA* Hance, *Journ. Bot.* xx. 78 (1882); *Forbes & Hemsl.* in *Journ. Linn. Soc.* xxiii. 204 (1887).

CHINA; Hongkong, *Ford*, fide Hance.

This species is not yet represented in Herb. Calcutta.

5. *ORMOSIA EMARGINATA* Benth. in *Hook. Kew. Journ.* iv. 77 (1852), and *Flor. Hong-Kong.* 96 (1861); *Forbes & Hemsl.* in *Journ. Linn. Soc.* xxiii. 204 (1887).

CHINA; Hongkong, *Ford!*

6. *ORMOSIA CALAVENSIS* Azaola in *Blanco Flor. Filip.* ed. 2, 230 (1845); *Vid. Sinops.* t. 41, f. H(1883) and *Rev. Pl. Vasc. Filip.* 113 (1886).

PHILIPPINES; Luzon, *Cuming* 1219! Alabat, *Vidal* 2617!

Vidal y Soler suggests that this is the same as *Ormosia* (*Arillaria*) *robusta*, but the suggestion can only be explained on the assumption that Sen. Vidal had no good specimens of *O. robusta* before him. There are no fruits of this species in Herb. Calcutta; if their structure is like that of *O. robusta* this species must be transferred to the subgenus *Arillaria*.

7. *ORMOSIA TRAVANCORICA* Bedd. *Flor. Sylvat.* i. t. 45 (1869); *Baker* in *Hook. fil. Flor. Brit. Ind.* ii. 253 (1878).

S. INDIA; S. Canara, Tinivelly, Travancore, *Beddome* (Ic.)

This species is only represented at Calcutta by *Beddome's* figure.

¶¶ LAYIA *Hook. & Arn.* (pro genere) *Bot. Beech. Voy.* 183. t. 38 (1833).

8. *ORMOSIA GLAUCA* Wall. *Plant. As. Rar.* ii. 23. t. 125 (1831) and *Cut.* 5338 (1832); *Baker* in *Hook. fil. Flor. Brit. Ind.* ii. 253 (1878); *Gamble, Mun. Ind. Timb.* xvii. (1881) and *Darjeel. List.* Ed. 2. 30 (1896); *Prain, Journ. As. Soc. Beng.* lxvi. 2. 467 (1897).

NEPAL; Souku, *Wallich!* SIKKIM; Sivoke, 2500 ft., *Gamble!*

9. *ORMOSIA HENRYI* Prain; leaflets 7-9, oblong, pale green, shortly stalked, thickly coriaceous, glabrous above, velvety beneath, pedicels as long as the calyx, pod narrow oblong, valves thick woody.

CHINA; Hupeh, *Henry* 7577!

A tree, with tawny-velvety branches. *Leaflets* usually 7, oblong lanceolate, very firmly coriaceous, 8-10 cm. long, 3-4.5 cm. wide, quite glabrous above, densely pale-buff velvety beneath, apex acute, base rounded, veins 8-9 pairs slender, somewhat prominent beneath; petiolules 5 mm. and main rachis 8-9 cm., closely shortly tawny pubescent. *Flowers* in axillary racemes 8-9 cm. long, tawny pubescent as are the pedicels 1.25 cm. long, bracts and bracteoles deciduous. *Calyx* campanulate 6 mm. long, silky. *Corolla* and *Stamens* not seen. *Pod* hard thick, 5-7 cm. long, 2.5 cm.

wide, the valves black, smooth externally, slightly swollen opposite the ripe seeds, very faintly ribbed alongside the upper suture, seeds 2-5, bright scarlet, small, 1 cm. long, .75 cm. wide, .5 cm. thick, separated by partitions of the tawny suberous endocarp in which they are embedded, with no trace of arillus.

Nearest *O. glauca* Wall. but differing greatly in the velvety under-surface of the leaves.

10. *ORMOSIA INOPINATA* Prain; leaflets 9, less often 11 or 7, rarely 5, ovate acuminate, beneath softly closely tawny pubescent on the midrib and veins, elsewhere sparsely pubescent, leaf-rachis and branchlets velvety, veins beneath prominent finely reticulate, large, distinctly stalked; pedicels long; pod compressed with thick woody valves.

VAR. *TYPICA*; corolla reddish, leaflets persistently pubescent.

KACHIN HILLS; Bansparao, near Sadon, Prain's Collector!

A large tree, with closely tawny-velvety sulcate branches. *Leaflets* rigidly subcoriaceous 15-16 cm. long, 5-6.5 cm. (the terminal leaflet sometimes 8 cm.) wide, above with midrib at first pubescent at length quite glabrous, rather pale-green shining, beneath persistently tomentose but the tomentum sparser with age, veins 7-9 pairs prominent beneath with a fine secondary reticulation visible also above especially on younger leaves, apex abruptly acuminate, base cuneate or rounded; petiolules 8 mm. and leaf-rachis 22 cm. long, closely velvety. *Flowers* in axillary racemes or few-branched panicles 20 cm. long closely velvety as are the pedicels 6 mm. (in fruit over 1 cm.) long, bracts and bracteoles minute deciduous, velvety. *Calyx* campanulate 9 mm. long, closely velvety both externally and within, teeth wide-triangular rather longer than the tube. *Corolla* reddish, twice as long as calyx. *Stamens* usually 9, all fertile, anthers oblong versatile. *Ovary* shortly stipitate, glabrous except for a few hairs on the dorsal and rather more on the ventral suture; style glabrous, filiform, tip circinate; stigma oblique; ovules 4 or 3. *Pod* hard flattened, with woody valves, 6 cm. long, 3 cm. wide, 1.25 cm. thick, with faint depressions between the 3 or 4 seeds, obliquely ovate-oblong, with a distinct stipe 6 mm. long and minute tip at apex of diagonal axis remote from stipe, ventral suture with prominent parallel ridges 6 mm. apart projecting beyond level of line of dehiscence; seeds cinnabar-red with a small white hilum and no arillus, ovate, 1.5 cm. long, 1 cm. across: sometimes slightly compressed and only 7 mm. thick.

10b. VAR. *DUBIA*; flowers yellow, leaves glabrescent with age on the under surface.

KACHIN HILLS; Bomkatom, between Lashio and Sadon, Prain's Collector!

A large tree, branchlets faintly sulcate. *Leaflets* rigidly subcoriaceous 6-10 cm. long, 3-4.5 cm. wide, the terminal leaflet almost 5 cm. wide, light-green, glabrous shining above, pale beneath very sparsely persistently pubescent, veins 7-9 pairs prominent beneath as is the fine secondary venation which is hardly visible above, apex acuminate, base cuneate or rounded; petiolules 6 mm. and leaf rachis 15 cm. long at first pubescent at length glabrous. *Flowers* in axillary racemes about 8 cm. long, rachis finely velvety as are the pedicels 6 mm. long not elongated in fruit. *Calyx* campanulate closely velvety both externally and within; teeth wide-triangular, rather longer than the tube. *Corolla* yellowish white, twice as long as calyx.

*Stamens and ovary as in O. inopinata.* Pod hard flattened, with woody valves, 5 cm. long, 3 cm. wide, 1.25 cm. thick, somewhat swollen opposite the 1-2 seeds, ovate-acute with distinct stipe 6 mm. long and a prominent tip at apex of vertical axis remote from stipe, ventral suture with blunt parallel ridges 6 mm. apart not projecting beyond level of line of dehiscence; seeds cinnabar-red with a small white hilum and no arillus, 1.25 cm. long, 1 cm. across, 8 mm. thick.

The foliage of the two trees here treated as varieties of one species is hardly distinguishable and the structure of their flowers is identical. The Native Collector who has communicated the specimens of both states, however, that besides the differences in colour of petals and in shape of pods and seeds, the two trees as they grow look very different. If this should turn out to be the case it may be necessary to treat the variety here described as a distinct species, to be known as *Ormosia dubia*.

11. *ORMOSIA BALANSÆ Drake del Castillo, Journ. de Botan. v. 215 (1891).*

TONKIN; near Ta-phap, in forests, *Balansa* 2178.

This species is not yet represented in Herb. Calcutta.

12. *ORMOSIA LAXA Prain*; leaflets 15, less often 17, lanceolate-acuminate, beneath and leaf-rachis and branchlets velvety, veins beneath inconspicuous, medium, distinctly stalked; pedicels long.

KACHIN HILLS; Shan Busti near Sadon, 5000 ft., *Prain's Collector!*

A tree, with tawny-velvety branches. *Leaflets* lanceolate, chartaceous, 6 cm. long, 2.5 cm. wide, at first finely deciduously puberulous above, densely softly tawny-velvety beneath, veins 5-6 pairs slender not prominent beneath, apex acuminate, tapering from the middle, base cuneate in the lower fourth; petiolules 5 mm. and main-rachis 20-25 cm. long, densely tawny-velvety. *Flowers* in axillary racemes or few-branched panicles 8-12 cm. long, densely tawny-velvety as are the pedicels 1.25-1.63 cm. long, bracts and bracteoles minute, deciduous, velvety. *Calyx* campanulate densely tawny-velvety outside, finely pubescent within, 1 cm. long, teeth wide-triangular almost as long as tube. *Corolla* twice as long as calyx. *Stamens* usually 5 fertile exerted in the open flower, sometimes 6 or 7, rarely 8 fertile—if 5, 6 or 7 fertile then with 3, 2, or 1 staminodes, always 2 stamens quite obsolete; anthers oblong, versatile. *Ovary* stipitate, silky with long tawny hairs especially on the sutures; style glabrous filiform, tip circinnate, stigma oblique; ovules 7. *Pod* 6-7 cm. long, 2.5 cm. wide, the valves black, smooth externally, slightly swollen opposite the ripe seeds, very faintly ribbed alongside both sutures; *seeds* 2-4, bright scarlet, 1 cm. long, 8 mm. wide, 8 mm. thick, separated by partitions of the pale woody endocarp in which they are embedded, with no arillus.

This very distinct species cannot be confounded with any of the hitherto described *Ormosias*.

13. *ORMOSIA SCANDENS Prain, Journ. As. Soc. Beng. lxxvi. 2, 147 and 467 (1897).*

MALAYAN PENINSULA; Perak, *Kunstler!*

This species is distinguished from all the others by its climbing habit; as its fruit is not yet known its precise systematic position cannot be positively stated. It seems, however, as if it might prove to be a species of § *Layia*. It may be

ultimately found advisable to subdivide § *Layia* into two groups; those with thick-walled large pods going into one and those with thin-walled short pods being placed in the other.

¶¶¶ AMACROTROPIS *Miq.* (pro sectione) *Flor. Ind. Bat. Suppl.* 294 (1860).

14. ORMOSIA SUMATRANA *Prain, Journ. As. Soc. Beng.* lxi. 2, 150 and 469 (1897). *Macrotropis sumatrana* *Miq. Flor. Ind. Bat. Suppl.* 294 (1860).

MALAY ARCHIPELAGO; Sumatra, *Teysmann* 3618! *Forbes* 2592! 2648!  
MALAYAN PENINSULA; Malacca, *Holmberg*!

15. ORMOSIA YUNNANENSIS *Prain*; leaflets 13, short-stalked, veins beneath distinctly raised, pedicels shorter than the calyx, pod sub-compressed with thin valves, seed ovate; racemes in rather close panicles.

CHINA; Yunnan, mountains in western Szemao, 5,000 ft. elev., *Henry* 11,967!

A small tree 20 ft. high, with rusty-pubescent branches. *Leaflets* oblong-lanceolate, firmly coriaceous, 10 cm. long, 3 cm. wide, glabrous above softly sparsely pubescent with longish adpressed ash-grey hairs beneath, veins about 10 pairs slender but prominent beneath, depressed above, secondary venation indistinct beneath not visible above, apex acute with a short finely acnminate sub-mucronulate tip, base shortly cuneate, petiolules 3.5 mm. and main-rachis 16 cm. long, rusty-pubescent. *Flowers* in axillary branched panicles 14 cm. long, rusty-pubescent as are the pedicels 2 mm. long, bracts and bracteoles ovate, 2.5 mm. long, 1.5 mm. wide, acute, deciduous, rusty pubescent. *Calyx* campanulate, rusty-pubescent both outside and inside, 8 mm. long, teeth triangular hardly as long as the tube. *Covolla* and *Stamens* not seen. *Pod* subsessile, irregularly orbicular if 1-seeded, oblong if 2-seeded, with a broadly triangular unilateral tip, 1.3 cm. wide, 2-3.25 cm. long, lineate between the seeds; valves thin, woody, rigid, black, glabrous, swollen opposite the seeds; *seeds* 1 or 2, bright scarlet, 8 mm. long, 6 mm. wide, 5 mm. thick, with white hilum and no arillus.

This species is most nearly related to *O. sumatrana*; its chief interest lies in its being the most northerly representative of the ¶ *Amacrotropis*, all the other known members of which are Malayan.

16. ORMOSIA MICROSPERMA *Baker* in *Hook. fl. Flor. Brit. Ind.* ii. 253 (1878); *Prain, Journ. As. Soc. Beng.* lxi. 2, 151 and 468 (1897). *O. coarctata* [*Benth. Mss.*]; *Kurz, Journ. As. Soc. Beng.* xlii. 2, 71 (1871) *in part, not of Jacks.*

MALAYAN PENINSULA; Malacca, *Griffith*! *Muingay*! *Derry*! *Perak, Kunstler*!

16b. VAR. RIDLEYI *Prain, Journ. As. Soc. Beng.* 2. 150 and 469 (1897).

MALAYAN PENINSULA; Singapore, *Ridley*!

This "variety" is probably entitled to specific rank.

17. *ORMOSIA PARVIFOLIA* Baker in *Hook. fil. Flor. Brit. Ind.* ii. 253 (1878); Prain, *Journ. As. Soc. Beng.* lxvi. 2. 149 and 469 (1897). *Macrotopis?* *bancana* Miq. *Flor. Ind. Bat. Suppl.* 295 (1860).

MALAY ARCHIPELAGO; Borneo, *Haviland* 57! Bangka, *Teysmann* 3405! MALAYAN PENINSULA; Singapore, *Ridley* 5929! 8096! Pahang, *Ridley* 1267! 5013! Malacca, *Griffith*! *Maingay*! *Goodenough*!

Besides being a very well characterised species this is much more widely distributed than most of the *Ormosias*. An authentic specimen of Miquel's *Macrotopis?* *bancana* in Herb. Calcutta shows that it is the same thing as Baker's *Ormosia parvifolia*. If the rule that the oldest specific epithet must under all circumstances be conserved is to be rigidly applied, then Mr. Baker's name must be abandoned in favour of the name *Ormosia bancana*.

§§ *CHÆNOLOBIUM* Miq. (pro genere) *Flor. Ind. Bat. Suppl.* 302 (1860).

18. *ORMOSIA POLITA* Prain. *O. nitida* Prain, *Journ. As. Soc. Beng.* lxvi. 2, 149 and 488 (1897) *not of Vogel*.

MALAYAN PENINSULA; Perak, *Kunstler*!

When a description was given of this very distinct species the fact was overlooked that there is already an *Ormosia nitida* Vogel, from Brazil; the name must therefore be replaced by another. This particular species is unlike the other *Chænolobia* is having perfectly glabrous dark-green shining leaves, and it moreover resembles the Malayan, as opposed to the Indo-Chinese *Layie* in having small pods. It also differs from the other *Chænolobia* in having well developed petiolules. Its agreement with *Chænolobium* lies in the fact that the leaf rachis is not prolonged beyond the last pair of leaflets which are attached along with the terminal leaflet.

19. *ORMOSIA SEPTEMJUGA* Prain, *Journ. As. Soc. Beng.* lxvi. 2. 468 (1897). *O. coarctata* Kurz, *Journ. As. Soc. Beng.* xlii. 2. 71 (1872) *in part, not of Jacks.* *Chænolobium septemjugum* Miq. *Flor. Ind. Bat. Suppl.* 302 (1860).

MALAYAN ARCHIPELAGO; Sumatra, *Diepenhorst* 2547!

An authentic specimen of Miquel's plant is preserved in the Calcutta Herbarium.

20. *ORMOSIA DECEMJUGA* Prain, *Journ. As. Soc. Beng.* lxvi. 2. 468 (1897). *Chænolobium decemjugum* Miq. *Flor. Ind. Bat. Suppl.* 302 (1860). *O. coarctata* Kurz, *Journ. As. Soc. Beng.* xlii. 2, 71 (1872) *in part, not of Jacks.*

MALAYAN ARCHIPELAGO; Sumatra, *Teysmann* 3715!

An authentic specimen of Miquel's plant is in Herb. Calcutta. This specimen shows, in my opinion, that Kurz was not justified in supposing that this is the same as *Chænolobium septemjugum* and that further he was not justified in believing that either this or *C. septemjugum* is the same as *Ormosia microsperma* which he supposed to be the same thing as *O. coarctata* Jacks., a Guiana species.

21. *ORMOSIA PACHYCARPA* Champ. ex Benth. in *Hook. Kew. Journ.* iv. 76 (1852); Benth., *Flor. Hong Kong.* 96 (1861); *Forbes & Hemsl.* in *Journ. Linn. Soc.* xxiii. 204 (1887).

CHINA; Canton, *Reeves*, Hong-Kong, *Lamont*, *Champion*, *Ford*!



Bentham states that this species was found by Reeves at Canton as well as by various collectors in Hong-Kong. Hemsley, however, says that Reeves' specimens are without locality. This species is very closely related to the next, though the two are nevertheless specifically quite distinct.

22. *ORMOSIA VENOSA* Baker in *Hook. fil. Flor. Brit. Ind.* ii. 254 (1878); *Prain, Journ. As. Soc. Beng.* lxvi. 2, 152 (1897).

MALAY PENINSULA; Malacca, *Maingay!*

A very distinct species, the one to which it is most closely related being the preceding, which comes from a very remote locality.

As regards distribution the most striking features connected with *Ormosia* are (1) the wide-spread occurrence of this genus throughout South Eastern Asia, from Hupeh in China to Bangka in the Malayan Archipelago, and from Travancore and Nepal to the Philippines: (2) the remarkably limited range of individual species with the exception of *O. parvifolia* (*O. bancana*) which extends from the Malay Peninsula to Bangka and Borneo, and to a less extent of *O. sumatrana* which occurs on both sides of the Straits of Malacca. *O. robusta* also has a wider range than most of the species for it extends from the valley of Assam through Silhet and Chittagong to Pegu and Tenasserim. It is interesting, however, to note that very closely related species such as *O. pachycarpa* and *O. venosa*, and again *O. yunnanensis* and *O. sumatrana*, may occur in widely separated localities. In the first instance one of the closely allied species is a native of Hong-Kong, the other is a native of Malacca; the specific names of the other pair indicate their respective habitats.

From the subjoined tabular statement it will be seen that of the 22 species enumerated one is S. Indian; one Himalayan; two, but one of these with two quite distinct varieties, occur in the Kachin Hills; five occur in China; one in Tonkin; one in the Philippines; one in Borneo, though this species also occurs in Bangka and throughout the Malay Peninsula; three in Sumatra, though one of these also occurs in Malacca; and eight in the Malay Peninsula, though one of these extends to Bangka and Borneo and another extends to Sumatra. The remaining species, which forms a very distinct subgenus, is widely spread from Assam to Tenasserim in a region where no other species occurs—a region moreover which separates the two chief centres of the genus in South Eastern Asia, viz.:—the Kachin-S. China area, and the Malay Peninsula. It is further worthy of remark that, so far, no species has been recorded either from Java or from Ceylon.

*Table of distribution of the South-Eastern-Asiatic species of Ormosia.*

| SPECIES.                | S. India. | C. and E. Himalaya. | Kachin Hills. | S. China. | Tonkin. | Assam and Chittagong. | Pegu and Tenasserim. | Sumatra. | Malay Peninsula. | Bangka. | Borneo. | Philippines. |
|-------------------------|-----------|---------------------|---------------|-----------|---------|-----------------------|----------------------|----------|------------------|---------|---------|--------------|
| <i>O. travancoorica</i> | ...       | 1                   | ..            | ..        | ..      | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. glauca</i>        | ...       | ..                  | 1             | ..        | ..      | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. laxa</i>          | ...       | ..                  | ..            | 1         | ..      | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. inopinata</i>     | ...       | ..                  | ..            | 1         | ..      | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. Henryi</i>        | ...       | ..                  | ..            | ..        | 1       | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. emarginata</i>    | ...       | ..                  | ..            | ..        | 1       | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. semicastra</i>    | ...       | ..                  | ..            | ..        | 1       | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. pachycarpa</i>    | ...       | ..                  | ..            | ..        | 1       | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. yunnanensis</i>   | ...       | ..                  | ..            | ..        | 1       | ..                    | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. Balansae</i>      | ...       | ..                  | ..            | ..        | ..      | 1                     | ..                   | ..       | ..               | ..      | ..      | ..           |
| <i>O. robusta</i>       | ...       | ..                  | ..            | ..        | ..      | 1                     | 1                    | ..       | ..               | ..      | ..      | ..           |
| <i>O. septemjuga</i>    | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | 1        | ..               | ..      | ..      | ..           |
| <i>O. decemjuga</i>     | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | 1        | ..               | ..      | ..      | ..           |
| <i>O. sumatrana</i>     | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | 1        | 1                | ..      | ..      | ..           |
| <i>O. microsperma</i>   | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | 1       | ..      | ..           |
| <i>O. scandens</i>      | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | ..      | ..      | ..           |
| <i>O. polita</i>        | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | ..      | ..      | ..           |
| <i>O. gracilis</i>      | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | ..      | ..      | ..           |
| <i>O. macrodisca</i>    | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | ..      | ..      | ..           |
| <i>O. venosa</i>        | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | ..      | ..      | ..           |
| <i>O. parvifolia</i>    | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | 1                | 1       | 1       | ..           |
| <i>O. calavensis</i>    | ...       | ..                  | ..            | ..        | ..      | ..                    | ..                   | ..       | ..               | ..      | ..      | 1            |
|                         | 1         | 1                   | 2             | 5         | 1       | 1                     | 1                    | 3        | 8                | 1       | 1       | 1            |

XIV.—*The Food-plants of the Butterflies of the Kanara District of the Bombay Presidency, with a Revision of the Species of Butterflies there occurring.*—By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

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In the Journal of the Bombay Natural History Society, vol. v, pp. 260–278, 349–375, plates A, B, C, D, E and F (1890), will be found a paper entitled “Notes on the Larvæ and Pupæ of some of the Butterflies of the Bombay Presidency,” by J. Davidson, B. C.S., and E. H. Aitken. In the same Journal, vol. x, pp. 237–259, 372–393, 568–584, vol. xi, pp. 22–63, plates I, II, III, IV, V, VI, VII, and VIII (1896–98), appears a paper, which is practically a continuation of the same subject, under the title “The Butterflies of the North Canara District of the Bombay Presidency,” by J. Davidson, T. R. Bell, and E. H. Aitken. The present paper is the third contribution to the subject, and is almost entirely based on the observations of Mr. T. R. D. Bell which have been placed at the disposal of the writer; but all the information contained in the above-cited papers regarding food-plants has been herein incorporated as well. The object of the paper is to give all the known food-plants of the butterflies bred by the three writers above mentioned in a compact form, and at the same time to give a revised list of the butterflies of the District of Kanara. In the first list the food-plants are arranged in botanical order, the order adopted being that of “The Flora of British India,” in seven volumes, by Sir J. D. Hooker (1872–1897). In the second list the butterflies found in the Kanara district are arranged in order, with the food-plants of the larvæ given where known below each. Very large additions have been made to the known food-plants, nearly all of which have been discovered by Mr. Bell. It is probable that no single person has ever bred such a variety of species of butterflies in one tropical locality as Mr. Bell has done. The omissions are very few, and these Mr. Bell is trying to supply. In the list of the butterflies it will be noticed the *Aphnæus concanus*, Moore, which is a dry-season form of *A. lohita*, Horsfield, and *Baoris philotas*, de Nicéville, which Mr. Bell considers to be a small variety of *Baoris guttatus*, Bremer and Grey, caused by the larva having been starved, have been omitted. Their names appeared on pp. 386, n. 119, and 47, n. 207 of the second paper cited above; while *Nacaduba plumbeomicans*, Wood-Mason and de Nicéville, and *N. atrata*, Horsfield; *Halpe moorei*, Watson, and *H. ceylonica*, Moore; *Notocrypta*

*feisthamelii*, Boisduval, and *N. restricta*, Moore, have been united, as these pairs of names are considered by the writer to represent but a single species in each instance. A considerable number of species of butterflies new to the lists have been added, bringing up the list from 233 (which includes the five species mentioned above as now omitted) to 245 species occurring in the Kanara district. The nomenclature has been brought up to date, the reasons for changing the published names being given in all cases. The importance of the Lists of Food-plants here presented need hardly be pointed out. No species of butterfly can be said to be known otherwise than superficially by a study of its perfect or imago form alone; much more than this is wanted; its egg, larva in all stages, and pupa, should be studied, described, and if possible compared with the transformations of the allied species at all stages. In India, and probably in all tropical countries, seasonal dimorphism occurs to a very great and often unexpected extent, and this phenomenon can only be worked out fully by extensive breeding experiments at all seasons of the year, but more especially at the changes of the seasons, from dry to wet and from wet to dry. The lists here given will be of use not only to the student and collector of butterflies in the south-western littoral of India, but to students and collectors of butterflies in most parts of India and to a less extent-elsewhere, many of the species enumerated being very widely spread. It will even be of value as regards other species in the same genus or allied genera, as these allied species and genera will frequently be found to feed either on the same or on allied plants elsewhere. For breeding purposes a knowledge of the food-plant of the larva is half the battle, given a knowledge of that fact, success in breeding becomes almost a certainty. It is in many cases, probably in most, only necessary to shut up the female of any given species of butterfly in as natural conditions as possible with its food-plant for it to lay eggs; the rest requires only some care and attention. The writers of the series of papers on Kanarese butterflies have mainly relied on actually finding the larvæ of the different species to breed them successfully, while the present writer has been successful chiefly in breeding from eggs laid by captured butterflies. To find the food-plant of any particular butterfly often entails much patient watching of the females when ovipositing. Mr. Bell has discovered the transformations of several species not hitherto described by himself, Messrs. Davidson and Aitken. These new descriptions will be found when dealing with the butterflies of the Kanara district in the second list.

- The larvæ of all the butterflies enumerated feed on vegetable food, except that of *Spalgis epius*, Westwood, which feeds on *Coccidæ*; these

are white, fluffy, onisciform insects commonly found on the young parts of many kinds of plants. They are often called "mealy-bugs" and "plant-lice," though the latter name is more properly applied to the *Aphidæ*. The larvæ of many kinds of butterflies will, when they cannot get vegetable food, eat each other or soft newly-formed pupæ. Mr. Bell has found that the greatest cannibals in this respect are the larvæ of certain *Lycænidæ*, and the worst amongst these again are the larvæ of *Zesius chrysomallus*, Hübner, for these will at times, even when plentifully supplied with their proper vegetable food, eat any larvæ which may be in a fit state to be eaten, *i.e.*, which are either on the point of casting their skins, have just cast them, or are just going to pupate. The lycænid larvæ which are most addicted, after that of *Z. chrysomallus*, to cannibalism, are those of the *Amblypodia* and *Tajuria* groups, those of *Arrhopala* and *Rapala* being nearly as bad. He has known one larva of *Tajuria cippus*, Fabricius, to eat up over a dozen young ones of its own species. In Kashmir Mr. Bell bred a single imago of *Hysudra selira*, Moore, from a larva which had been reared on the dead leaves and flowers of its food-plant, *Indigofera atropurpurea*, Hamilt. (Natural Order *Leguminosæ*), together with several newly-formed pupæ of its own species. The imago was a very fine, large specimen, so that the insect diet evidently agreed with the larva. Mr. Bell particularly noted this fact, as in all his previous experience he had been led to the conclusion that a cannibal diet was bad for the stomachs of the larvæ practising the habit of eating up its fellows, as they, as a general rule, have not been healthy, and have died before pupating. The tendency to cannibalism is not confined to the *Lycænidæ*, but exists also amongst the *Pierinæ*; the larvæ of *Appias* will eat each other and any other species of larva feeding on the same food-plant as themselves if forced to it by hunger. He has seen the larvæ of *Appias libythea*, Fabricius, and *Appias taprobana*, Moore, eat freshly-formed pupæ of their own species, as well as larvæ changing their skins, and also the larvæ and pupæ of *Leptosia xiphia*, Fabricius. Some of the caterpillars of the *Danainæ* will, when food is not to be had, eat individuals of their own species. Mr. Bell has never known a larva to eat another larva feeding on a food-plant of a species different from its own, so it is probable that all larvæ taste strongly of the plant they feed on, and it is also probable that cannibal larvæ are hardly conscious that they are eating up each other, being only guided to their proper food by the sense of taste, or possibly to a less extent by the sense of smell. None of the larvæ of the *Satyrinæ*, *Elymninæ*, *Amathusiinæ*, *Acræinæ*, *Nymphalinæ*, *Libythæinæ*, *Nemeobiinæ*, *Papilioninæ*, or *Hesperiidæ*, have been found by Mr. Bell to eat anything but vegetable food. All rhopalocerous larvæ, however, with but very few

exceptions, eat their own cast-off skins while these are still soft and moist; and the young larvæ on emerging from the egg will almost invariably under normal conditions make their first meal off the empty egg-shell. Mr. Bell notes that all the butterfly larvæ he has bred change their skins five times from the time they leave the egg to the time they turn to pupæ.

As regards the larvæ of the *Lycaenidæ*, whether they are attended by ants or not, it may be noted that those which live in harmony with ants, and are probably largely dependant on their well-being on ants, the presence of the particular species of ant that lives with any particular species of butterfly larva often fixes the choice of the butterfly laying her eggs on a particular plant or not. If the right plant has no ants, or the ants on that plant are not the right species, the butterfly will lay no eggs on that plant. Some larvæ will certainly not live without the ants, and many larvæ are extremely uncomfortable when brought up away from their hosts or masters. In many cases it is just as important for breeding purposes to know the right species of ants as to know the right food-plant. In Kanara this is particularly noticeable in the cases of *Catalius ananda*, de Nicéville, *Zesius chrysomallus*, Hübner, *Aphnæus lohita*, Horsfield, and *Catapœcilma elegans*, Druce. *C. ananda* is "protected" by ants of the genus *Cremastogaster*. On one occasion Mr. Bell was collecting larvæ at Katgal, and the ants were principally on *Zizyphus rugosa*, Lamk. (Natural Order *Rhamnæ*) but were also swarming all over six or seven species of different trees all round, and on all of these trees there were larvæ of *C. ananda* covered with ants and eating the leaves of the trees in all cases. Since then Mr. Bell has noticed the larva of *C. ananda* eating the leaves of many different plants and always in company with the same species of ants. With regard to the *Zesius*, *Aphnæus* and *Catapœcilma* mentioned above, the female butterflies first look for the right species of ants, and the species of food-plant seems to be quite a secondary consideration, at any rate to a considerable extent. The larvæ of *Zesius* may be found on very nearly any plant that harbours the large red ant, *Ecophylla smaragdina*, Fabricius, so much so that Mr. Bell has often had a strong suspicion that the butterfly larvæ will occasionally eat the ant larvæ, although he has not actually seen them do so. The larva of this butterfly feeds on many species of plants not recorded in the lists, as Mr. Bell made no particular note of them, all these plants being affected by the large red ants. The larvæ of *Aphnæus* and *Catapœcilma* are only found on plants affected by ants of the genus *Cremastogaster*. As regards the four species of butterflies named above, the larvæ are often found in the ants' nests, and their pupæ also, but not invariably.

Mr. Bell has furnished me with the following detailed information on the subject of lycænid butterflies and ants:—

1. *Neopitheops salmora*, Butler. The larva but not the pupa is sometimes attended by ants, generally by a species of *Pheidole*.

2. *Cyaniris puspa*, Horsfield. The larva is always attended by small ants of the genus *Oremastogaster*, but will live comfortably without them; the pupa is not generally attended.

3. *Lycænesthes emolus*, Godart. The larvæ, which are gregarious, are always attended by the common and large fierce red ant, *Ecophylla smaragdina*, Fabricius.

4. *Jamides bochus*, Cramer. The larvæ are sometimes attended by ants of the genus *Oremastogaster*.

5. *Lampides celeno*, Cramer. Sometimes attended by ants.

6. *Euchrysops pandava*, Horsfield. Larva attended by ants generally.

7. *Oastalius ananda*, de Nicéville. Larva and pupa always strongly attended by ants of the genus *Oremastogaster*, and will not live well without them.

8. *Polyommatus basticus*, Linuæus. Larva sometimes attended by ants of the genus *Oremastogaster*.

9. *Surendra quercetorum*, Moore. The imago may often be seen settled on branches of trees and bushes swarming with ants of the genus *Oremastogaster*, and being caressed by them; the larva is attended by the same ants.

10. *Thaduka multicaudata*, Moore. The larvæ and pupæ are gregarious, and are sometimes attended by ants of the genus *Oremastogaster*, and by *Ecophylla smaragdina*, Fabricius.

11. *Arrhopala centaurus*, Fabricius. Both larva and pupa are always attended by *Ecophylla smaragdina*, Fabricius.

12. *Arrhopala amantes*, Hewitson. Both larva and pupa are always attended by *Ecophylla smaragdina*, Fabricius.

13. *Arrhopala canaraica*, Moore. Larva and pupa always attended by *Ecophylla smaragdina*, Fabricius, or by a small blackish ant.

14. *Arrhopala bazalus*, Hewitson. Larva and pupa always attended by ants of the genus *Oremastogaster*.

15. *Curetis thetis*, Drury. Mr. Bell has found hundreds of the larvæ of this species, but not one was attended by ants. No doubt the long "bottle-brush" extrusible processes with which the larva is furnished are used to drive away ants as well as ichneumons.

16. *Zesius chrysomallus*, Hübner. The larva is always attended by *Ecophylla smaragdina*, Fabricius, and will not live well without them.

17. *Aphnæus vulcanus*, Fabricius. Larva and pupa always attended by ants of the genus *Cremastogaster*.

18. *Aphnæus lohita*, Horsfield. Larva and pupa sometimes attended by *Ecophylla smaragdina*, Fabricius, and always by ants of the genus *Cremastogaster*.

19. *Tajuria indra*, Moore. Larva always attended by ants, but not to a very great extent.

20. *Tajuria cippus*, Fabricius. The larva is rarely attended by ants, although the female butterfly always lays her eggs on plants which are frequented by ants of the genus *Cremastogaster*.

21. *Catapœcilma elegans*, Druce. The larva and pupa are always attended by swarms of ants of the genus *Cremastogaster*, in fact they are found both in the permanent nests of those ants, and in small temporary nests formed by them on the branches, which latter are generally made to shelter scale insects.

22. *Deudorix epijarbas*, Moore. The larva is sometimes attended by ants of the genus *Cremastogaster*.

23. *Zinaspia todara*, Moore. Larva always attended by *Ecophylla smaragdina*, Fabricius, or ants of the genus *Cremastogaster*, and lives badly without them.

24. *Rapala schistacea*, Moore. The larva is desultorily attended by ants of the genus *Cremastogaster*.

25. *Rapala lankana*, Moore. Larva always attended by *Ecophylla smaragdina*, Fabricius.

26. *Virachola isocrates*, Fabricius. Ants are sometimes found in the fruits that contain larvæ of this butterfly, but do not seem to actually attend them.

27. *Virachola perse*, Hewitson. The same remarks apply to this species as to the last.

In many instances it will be found that the names of the plants given in the two lists below differ in spelling from that given in the two previously published papers on Kanarese butterflies. In the present paper all the names have been carefully revised, and the spelling herein given should be followed. It was not thought necessary also to draw particular attention to these variants, or to those cases in which the names of the butterflies were also incorrectly spelt.

At the end of Parts I and II will be found lists of the food-plants, and the butterflies whose larvæ feed on them, of a few butterflies discovered by Mr. Bell in the Western Himalayas and Kashmir.



## PART I.

*A List of the Food-plants arranged in the order of "The Flora of British India" on which the larvæ of the Butterflies of the Kanara District feed.*

## Order IV. ANONACEÆ.

1. UNONA DISCOLOR, Vahl.  
*Papilio agamemnon*, Linnæus.
2. UNONA LAWII, Hook. f. and T.  
*Papilio eurypylus jason*, Esper.  
*Papilio antiphates alcibiades*, Fabricius.
3. POLYALTHIA LONGIFOLIA, Benth. and H. f.\* The 'debbar,' or 'asoka.'  
*Papilio agamemnon*, Linnæus.
4. ANONA SQUAMOSA, Linn. The custard-apple.  
*Virachola perse*, Hewitson.  
*Papilio agamemnon*, Linnæus.
5. ANONA RETICULATA, Linn.  
*Papilio agamemnon*, Linnæus.
6. SACCOPETALUM TOMENTOSUM, Hook. f. and T.  
*Charaxes inna*, Butler.  
*Papilio agamemnon*, Linnæus.  
*Papilio eurypylus jason*, Esper.  
*Papilio nominus*, Esper.

## Order XI. CAPPARIDEÆ.

7. CRATEVA RELIGIOSA, Forst.  
*Leptosia xiphia*, Fabricius.  
*Hebomoia australis*, Butler.  
*Appias libythea*, Fabricius.  
*Appias taprobana*, Moore.
8. CADABA INDICA, Lamk.  
*Teracolus etrida*, Boisduval.

\* In the first Kanara paper (p. 263, n. 67) this plant is given under its synonymic name *Gualteria* [recte *Guatteria*] *longifolia*, Wall.

9. CAPPARIS HEYNEANA, Wall. The plants of this genus are generally known as 'capers.'

*Leptosia xiphia*, Fabricius.

*Hebomoia australis*, Butler.

*Nepheronia pingasa*, Moore.

*Nepheronia hippia*, Fabricius.

*Appias wardii*, Moore.

*Huphina remba*, Moore.

10. CAPPARIS DIVARICATA, Lamk.

*Belenois mesentina*, Cramer.

11. CAPPARIS MOONII, Wight.

*Hebomoia australis*, Butler.

12. CAPPARIS SEPIARIA, Linn.

*Leptosia xiphia*, Fabricius.

*Teracolus eucharis*, Fabricius.

*Ixias pyrene*, Linnæus.

*Ixias marianne*, Cramer.

*Hebomoia australis*, Butler.

*Huphina nerissa*, Fabricius.

13. CAPPARIS HORBIDA, Linn. f.

*Leptosia xiphia*, Fabricius.

*Nepheronia hippia*, Fabricius.

*Appias libythea*, Fabricius.

*Huphina nerissa*, Fabricius.

14. ? CAPPARIS TENERA, Dalz.

*Prioneris sita*, Felder.

#### Order XIII. VIOLACEÆ.

15. ALSODEIA ZEYLANICA, Thwaites.

*Atella alcippe*, Cramer.

#### Order XIV. BIXINEÆ.

16. FLACOURTIA MONTANA, Grah.

*Cupha placida*, Moore.

*Atella phalantha*, Drury.

17. HYDNOCARPUS WIGHTIANA, Blume.

*Cirrhochroa thais*, Fabricius.

## Order XIX. PORTULACEÆ.

18. PORTULACA OLERACEA, Linn.

*Hypolimnas bolina*, Linnæus.*Hypolimnas misippus*, Linnæus.

## Order XXV. DIPTEROCARPEÆ.

19. HOPEA WIGHTIANA, Wall.

*Arrhopala centaurus*, Fabricius.*Arrhopala amantes*, Hewitson.*Arrhopala canaraica*, Moore.*Arrhopala bazalus*, Hewitson.*Rathinda amor*, Fabricius.

## Order XXVI. MALVACEÆ.

20. THESPESIA LAMPAS, Dalz. and Gibs.

*Neptis kallaura*, Moore.*Neptis jumbah*, Moore.

21. KYDIA CALYCINA, Roxb.

*Neptis jumbah*, Moore.

22. BOMBAX MALABARICUM, DC.

*Neptis jumbah*, Moore.

## Order XXVII. STERCULIACEÆ

23. HELICTERES ISORA, Linn.

*Neptis jumbah*, Moore.*Caprona ransonnetii*, Felder.

24. WALTHERIA INDICA, Linn.

*Hesperia galba*, Fabricius.

## Order XXVIII. TILIACEÆ.

25. GREWIA MICROCOS, Linn.

*Neptis jumbah*, Moore.*Coladenia indrani*, Moore.

26. GREWIA sp.

*Charaxes athamas*, Drury.

## Order XXXIII. RUTACEÆ.

27. RUTA GRAVEOLENS, Linn., var. ANGUSTIFOLIA, Pers. The rue.  
*Papilio demoleus*, Linnæus.
28. EVODIA ROXBURGHIANA, Benth.  
*Papilio demolion liomedon*, Moore.  
*Papilio paris tamilana*, Moore.
29. ZANTHOXYLUM RHETSA, DC.  
*Papilio polytes*, Linnæus.  
*Papilio helenus daksha*, Hampson.  
*Papilio buddha*, Westwood.
30. ACRONYCHIA LAURIFOLIA, Blume.  
*Papilio demolion liomedon*, Moore.
31. GLYCOSMIS PENTAPHYLLA, Correa.  
*Neopitheops zalmora*, Butler.  
*Papilio demoleus*, Linnæus.  
*Papilio polytes*, Linnæus.  
*Papilio helenus daksha*, Hampson.  
*Papilio abrisa*, Kirby.
32. MURRAYA KENIGII, Spreng.  
*Papilio demoleus*, Linnæus.
33. PARAMIGNYA MONOPHYLLA, Wight.  
*Papilio polymnestor*, Cramer.
34. ATALANTIA MONOPHYLLA, Correa. The wild lime.  
*Papilio polymnestor*, Cramer.
35. CITRUS MEDICA, Linn. The sour lime or citron or lemon or sweet lime.  
*Chilades laius*, Cramer.  
*Papilio polytes*, Linnæus.  
*Papilio helenus daksha*, Hampson.
36. CITRUS DECUMANA, Linn. The pomelo or shaddock.  
*Papilio demoleus*, Linnæus.  
*Papilio polytes*, Linnæus.  
*Papilio helenus daksha*, Hampson.

37. *ÆGLE MARMÉLOS*, Correa. The Bael tree.  
*Papilio demoleus*, Linnæus.

Order XXXVII. MELIACEÆ.

38. *AGLAIA ROXBURGHIANA*, Miq.  
*Charaxes inna*, Butler.

Order XXXIX. OLACINEÆ.

39. *OLAX SCANDENS*, Roxb.  
*Amblypodia anita*, Hewitson.

Order XLI. CELASTRINEÆ.

40. *SALACIA OBLONGA*, Wall.  
*Bindahara sugriva*, Horsfield.

Order XLII. RHAMNEÆ.

41. *ZIZYPHUS JUJUBA*, Lamk. The 'baer' tree or 'jajube' tree.  
*Neptis jumbah*, Moore.  
*Tarucus theophrastus*, Fabricius.  
*Castalius rosimon*, Fabricius.  
*Castalius ananda*, de Nicéville.  
*Castalius ethion*, Doubleday and Hewitson.  
*Aphnæus vulcanus*, Fabricius.

42. *ZIZYPHUS XYLOPYRUS*, Willd.  
*Neptis jumbah*, Moore.  
*Castalius ananda*, de Nicéville.  
*Castalius ethion*, Doubleday and Hewitson.  
*Rapala varuna*, Horsfield.

43. *ZIZYPHUS RUGOSA*, Lamk.  
*Neptis jumbah*, Moore.  
*Castalius ananda*, de Nicéville.  
*Castalius decidia*, Hewitson.  
*Aphnæus vulcanus*, Fabricius.  
*Aphnæus lohita*, Horsfield.  
*Rapala varuna*, Horsfield.  
*Rapala melampus*, Cramer.

Order XLIV. SAPINDACEÆ.

44. *ALLOPHYLUS COBBE*, Blume.  
*Odontoptilum angulata*, Felder.

45. SCHLEICHERA TRIJUGA, Willd.  
*Catochrysops strabo*, Fabricius.  
*Bathinda amor*, Fabricius.

Order XLVI. ANACARDIACEÆ.

46. MANGIFERA INDICA, Linn. The mango.  
*Euthalia garuda*, Moore.
47. ANACARDIUM OCCIDENTALE, Linn. The cashewnut.  
*Euthalia garuda*, Moore.
48. BUCHANANIA LATIFOLIA, Roxb.  
*Lycænesthes lycænina*, Felder.

Order XLIX. CONNARACEÆ.

49. ROUREA SANTALOIDES, W. and A.  
*Charaxes wardii*, Moore.
50. CONNARUS RITCHIEI, Hook. f.  
*Deudorix epijarbas*, Moore.

Order L. LEGUMINOSÆ.

51. MILLETIA RACEMOSA, Benth.  
*Neptis jumbah*, Moore.  
*Hasora chabrona*, Plötz.
52. SESBANIA ACULEATA, Pers.  
*Tarucus telicanus*, Lang, in Bombay.  
*Terias hecabe*, Linnæus.
53. ZORNIA DIPHYLLA, Pers. A vetch-like plant.  
*Vanessa cardui*, Linnæus.  
*Plebeius trochilus*, Freyer.  
*Zizera lysimon*, Hübner.  
*Zizera otis*, Fabricius.
54. OUGEINIA DALBERGIOIDES, Benth.  
*Catochrysops strabo*, Fabricius.  
*Euchrysops cnejus*, Fabricius.  
*Tarucus telicanus*, Lang.  
*Ouretis bulis*, Doubleday and Hewitson.  
*Rapala melampus*, Cramer.

55. *ABRUS PRECATORIUS*, Linn.*Lampides celeno*, Cramer.*Curetis thetis*, Drury.56. *BUTEA FRONDOSA*, Roxb. Bastard teak.*Jamides bochus*, Cramer.*Polyommatus bœticus*, Linnæus.57. *CAJANUS INDICUS*, Spreng.*Polyommatus bœticus*, Linnæus.58. *CYLISTA SCARIOSA*, Ait.*Cyaniris puspa*, Horsfield.*Everes argiades*, Pallas.*Catochrysops strabo*, Fabricius.*Euchrysops cnejus*, Fabricius.59. *DALBERGIA LATIFOLIA*, Roxb. Blackwood or rosewood tree.*Neptis viraja*, Moore.*Neptis jumbah*, Moore.*Tapena thwaitesi*, Moore.60. *DALBERGIA RUBIGINOSA*, Roxb.*Tapena thwaitesi*, Moore.61. *DALBERGIA CONFERTIFLORA*, Benth.*Neptis kallaura*, Moore.62. *DALBERGIA TAMARINDIFOLIA*, Roxb.*Tapena thwaitesi*, Moore.63. *DALBERGIA VOLUBILIS*, Roxb.*Neptis viraja*, Moore.\**Tapena thwaitesi*, Moore.64. *PONGAMIA GLABRA*, Vent.*Jamides bochus*, Cramer.*Lampides celeno*, Cramer.*Curetis thetis*, Drury.*Hasora (Parata) alexis*, Fabricius.

\* In the second Kanara paper (p. 251, n. 41) *Dalbergia racemosa* appears as a food-plant of *N. viraja*, Moore, but this is a wrong identification for *Dalbergia volubilis*.

65. DERRIS SCANDENS, Benth.

*Hasora (Parata) butleri*, Aurivillius.

*Tupena thwaitesi*, Moore.

66. DERRIS ULIGINOSA, Benth.

*Hasora badra*, Moore.

67. DERRIS HEYNEANA, Benth.

*Curetis thetis*, Drury.

*Hasora (Parata) butleri*, Aurivillius.

68. CÆSALPINIA MIMOSOIDES, Lam.

*Neptis (Rahinda) hordonia*, Stoll.

*Charaxes athamas*, Drury.

69. POINCIANA REGIA, Bojer. The gold-mohar tree.

*Charaxes athamas*, Drury.

*Terias silhetana*, Wallace.

70. WAGATEA SPICATA, Dalz.

*Neptis kallaura*, Moore.

*Neptis jumbah*, Moore.

*Charaxes wardii*, Moore.

*Charaxes fabius*, Fabricius.

*Lycænesthes emolus*, Godart.

*Lycænesthes lycænina*, Felder.

*Nacaduba atrata*, Horsfield.

*Euchrysops pandava*, Horsfield.

*Curetis thetis*, Drury.

*Aphnæus lohita*, Horsfield.

*Rapala lankana*, Moore.

*Terias silhetana*, Wallace.

71. CASSIA FISTULA, Linn. Indian Laburnum.

*Catopsilia crocale*, Cramer.

72. CASSIA OCCIDENTALIS, Linn.

*Catopsilia pyranthe*, Linnæus.

*Terias hecabe*, Linnæus.

73. CASSIA TORA, Linn.

*Terias hecabe*, Linnæus.



74. CASSIA SIAMEA, Lam.  
*Oatopsilia crocale*, Cramer.
75. CASSIA GLAUCA, Lam.  
*Terias hecabe*, Linnæus.
76. CASSIA PUMILA, Lam.  
*Terias libythea*, Fabricius.
77. SARACA INDICA, Linn.  
*Lycænesthes emolus*, Godart.  
*Lampides celeno*, Cramer.  
*Cheritra jaffra*, Butler.
78. TAMARINDUS INDICA, Linn. The tamarind.  
*Charaxes fabius*, Fabricius.  
*Virachola isocrates*, Fabricius.
79. XYLIA DOLABRIFORMIS, Benth. The Pegu iron-wood.  
*Neptis jumbah*, Moore.  
*Cyaniris puspa*, Horsfield.  
*Jamides bochus*, Cramer.  
*Euchrysops pandava*, Horsfield.  
*Arrhopala centaurus*, Fabricius.  
*Arrhopala amantes*, Hewitson.  
*Ouretis thetis*, Drury.  
*Zesius chrysomallus*, Hübner.  
*Aphnæus lohita*, Horsfield.  
*Cheritra jaffra*, Butler.  
*Rapala varuna*, Horsfield.  
*Coladenia indrani*, Moore.
80. ACACIA INTSIA, Willd.  
*Neptis (Rahinda) hordonia*, Stoll. Form of larva with short processes.  
*Nacaduba noreia*, Felder.  
*Surendra quercetorum*, Moore.  
*Zinaspæ todara*, Moore.
81. ACACIA INTSIA, var. CÆSIA, W. and A.  
*Nacaduba noreia*, Felder.  
*Zinaspæ todara*, Moore.  
*Rapala schistacea*, Moore.  
*Rapala lankana*, Moore.

82. ACACIA PENNATA, Willd.  
*Neptis (Bahinda) hordonia*, Stoll. Form of larva with long processes.  
*Charaxes athamas*, Drury.  
*Nacaduba noreia*, Felder.  
*Surendra quercetorum*, Moore.  
*Zinaspia todara*, Moore.  
*Rapala schistacea*, Moore.  
*Rapala lankana*, Moore.
83. ALBIZZIA LEBBEK, Benth.  
*Neptis viraja*, Moore.  
*Charaxes athamas*, Drury.
84. Genus and Species unknown.  
*Neptis varmona*, Moore.

## Order LIII. CRASSULACEÆ.

85. BRYOPHYLLUM CALY CINUM, Salisb.  
*Talica da nyseus*, Guérin.

## Order LVIII. COMBRÉTACEÆ.

86. TERMINALIA BELLERICA, Roxb.  
*Badamia exclamationis*, Fabricius.  
*Cupitha purreea*, Moore.
87. TERMINALIA TOMENTOSA, Bedd.  
*Arrhopala centaurus*, Fabricius.  
*Zesius chrysomallus*, Hübner.  
*Catapœcilma elegans*, Druce.
88. TERMINALIA PANICULATA, Roth.  
*Lycœnesthes emolus*, Godart.  
*Castalius ananda*, de Nicéville.  
*Arrhopala centaurus*, Fabricius.  
*Arrhopala amantes*, Hewitson.  
*Arrhopala bazalus*, Hewitson.  
*Zesius chrysomallus*, Hübner.  
*Aphnæus lohita*, Horsfield.  
*Catapœcilma elegans*, Druce.  
*Cupitha purreea*, Moore.

89. COMBRETUM OVALIFOLIUM, Roxb.  
*Cupitha purrea*, Moore.

90. COMBRETUM EXTENSUM, Roxb.  
*Lycænesthes emolus*, Godart.  
*Ismene fergusonii*, de Nicéville.  
*Bibasis sena*, Moore.  
*Badamia exclamationis*, Fabricius.

91. QUISQUALIS INDICA, Linn.  
*Rapala schistacea*, Moore.  
*Rapala varuna*, Horsfield.

#### Order LIX. MYRTACEÆ.

92. PSIDIUM GUYAVA, Linn. The guava.  
*Zesius chrysomallus*, Hübner.  
*Aphnæus lohita*, Horsfield.

93. EUGENIA ZEYLANICA, Wight.  
*Rathinda amor*, Fabricius.

94. CAREYA ARBOREA, Roxb.  
*Euthalia (Cynitia) lepidea*, Butler.  
*Rathinda amor*, Fabricius.

#### Order LX. MELASTOMACEÆ.

95. MELASTOMA MALABATHRICUM, Linn.  
*Euthalia (Cynitia) lepidea*, Butler.

#### Order LXI. LYTHRACEÆ.

96. LAGERSTROMIA LANCEOLATA, Wall.  
*Arrhopala centaurus*, Fabricius.  
*Arrhopala amantes*, Hewitson.  
*Aphnæus lohita*, Horsfield.  
*Catapocilma elegans*, Druce.

97. PUNICA GRANATUM, Linn. The pomegranate.  
*Virachola isocrates*, Fabricius.

## Order LXIV. PASSIFLOREÆ.

98. *MODECCA PALMATA*, Lam. The wild passion-flower.  
*Telchinia violæ*, Fabricius.  
*Cethosia mahratta*, Moore.  
*Cynthia saloma*, de Nicéville.

## Order LXV. CUCURBITACEÆ.

99. *ZEHNERIA UMBELLATA*, Thwaites.  
*Parthenos virens*, Moore.

## Order LXXI. ARALIACEÆ.

100. *HEPTAPLEURUM VENULOSUM*, Seem. An ivy-like creeper.  
*Ismene gomata*, Moore.

## Order LXXV. RUBIACEÆ.

101. *ADINA CORDIFOLIA*, Hook. f.  
*Athyma selenophora*, Kollar.
102. *STEPHEGYNE PARVIFOLIA*, Korth.  
*Limenitis (Moduza) procris*, Cramer.
103. *WENDLANDIA EXSERTA*, DC.  
*Limenitis (Moduza) procris*, Cramer.  
*Athyma inara*, Doubleday and Hewitson.
104. *MUSSENDIA FRONDOSA*, Linn.  
*Limenitis (Moduza) procris*, Cramer.  
*Athyma inara*, Doubleday and Hewitson.
105. *RANDIA ULIGINOSA*, DC.  
*Virachola isocrates*, Fabricius.  
*Virachola perse*, Hewitson.
106. *RANDIA DUMETORUM*, Lamk.  
*Virachola perse*, Hewitson.
107. *IXORA COCCINEA*, Linn.  
*Rathinda amor*, Fabricius.

## Order LXXVIII. COMPOSITÆ.

108. BLUMEA sp. A kind of thistle.  
*Vanessa cardui*, Linnæus.

## Order LXXXVIII. MYRSINÆÆ.

109. EMBELIA ROBUSTA, Roxb.  
*Abisara fraterna*, Moore.  
*Nacaduba atrata*, Horsfield.

110. ARDISIA HUMILIS, Vahl.  
*Abisara fraterna*, Moore.  
*Nacaduba atrata*, Horsfield.

## Order XC. EBENACEÆ.

111. DIOSPYROS MELANOXYLON, Roxb. Ebony.  
*Symphædra nais*, Forster.  
*Euthalia (Dopha) laudabilis*, Swinhoe.

112. DIOSPYROS CANDOLLEANA, Wight. Ebony.  
*Euthalia (Dopha) laudabilis*, Swinhoe.

## Order XCII. OLEACEÆ.

113. LINOCIERA MALABARICA, Wall.  
*Athyma ranga*, Moore.

114. OLEA DIOICA, Roxb.  
*Athyma ranga*, Moore.

## Order XCIII. SALVADORACEÆ.

115. SALVADORA PERSICA, Linn.  
*Teracolus amata*, Fabricius.

## Order XCIV. APOCYNACEÆ.

116. HOLARRHENA ANTIDYSENTERICA, Wall.  
*Euploea (Crastia) core*, Cramer.

117. NERIUM ODORUM, Soland. The oleander.  
*Euploea (Crastia) core*, Cramer.

118. *AGANOSMA CIMOSA*, G. Don.  
*Hestia malabarica*, Moore.

119. *ICHNOCARPUS FRUTESCENS*, Br.  
*Euplœa (Orastia) core*, Cramer.  
*Euplœa (Narmada) corela*, Godart.

#### Order XCV. ASCLEPIADEÆ.

120. *CRYPTOLEPIS BUCHANANI*, Roem. and Sch.  
*Danaïs (Parantica) aglea*, Cramer.

121. *CALOTROPIS GIGANTEA*, Br. The 'Madar.'  
*Danaïs (Limnas) chrysippus*, Linnæus.

122. *ASCLEPIAS CURASSAVICA*, Linn.  
*Danaïs (Limnas) chrysippus*, Linnæus.

123. *TYLOPHORA TENNIS*, Blake.  
*Danaïs (Parantica) aglea*, Cramer.

124. *DREEGA VOLUBILIS*, Benth. Wax plant.  
*Danaïs (Tirumala) limniace*, Cramer.  
*Danaïs (Tirumala) septentrionis*, Butler.

125. Genus and Species unknown.  
*Danaïs (Salatura) ptesippus*, Linnæus.

#### Order C. BORAGINEÆ.

126. *HELIOTROPIUM STRIGOSUM*, Willd.  
*Plebeius trochilus*, Freyer.

#### Order CI. CONVULVULACEÆ.

127. *ARGYREIA SPECIOSA*, Sweet.  
*Zesius chrysomallus*, Hübner.

128. *ARGYREIA SERICEA*, Dalz. and Gibs.  
*Aphnæus lohita*, Horsfield.

#### Order CIX. ACANTHACEÆ.

129. *NELSONIA CAMPESTRIS*, Br.  
*Precis lemonias*, Linnæus.  
*Zizera gaika*, Trimen.

130. *HYGROPHILA SPINOSA*, T. Anders.

*Precis almana*, Linnæus.

*Precis lemonias*, Linnæus.

*Precis hierta*, Fabricius.

*Precis orithyia*, Linnæus.

*Precis atlites*, Linnæus.

131. *DÆDALACANTHUS ROSEUS*, T. Anders.

*Celænorhynchus leucocera*, Kollar.

132. *STROBILANTHES CALLOSUS*, Nees.

*Precis iphita*, Cramer.

*Precis lemonias*, Linnæus.

*Kallima horsfieldii*, Kollar.

*Celænorhynchus ambaroesa*, Moore.

*Celænorhynchus fusca*, Hampson.

133. *BLEPHARIS ASPERRIMA*, Nees.

*Sarangesa purendra*, Moore.

134. *BARLERIA PRIONITIS*, Linn.

*Precis lemonias*, Linnæus.

135. *BARLERIA* sp.

*Precis hierta*, Fabricius.

*Precis atlites*, Linnæus.

136. *ERANTHEMUM MALABARICUM*, Clarke.

*Kallima horsfieldii*, Kollar.

*Doleschallia polibete*, Cramer.

137. *ERANTHEMUM* sp.

*Celænorhynchus leucocera*, Kollar.

138. Genus and Species unknown.

*Sarangesa dasahara*, Moore.

#### Order CXI. VERBENACEÆ.

139. ? *LIPPIA NODIFLORA*, Rich.

*Precis almana*, Linnæus. Mr. Bell thinks this food-plant is very doubtful for *P. almana*.

140. CLERODENDRON INFORTUNATUM, Gaertn.  
*Zesius chrysomallus*, Hübner.

Order CXVI. AMARANTACEÆ.

141. CYATHULA PROSTRATA, Blume.  
*Coladenia dan*, Fabricius.
142. ACHYRANTHES ASPERA, Linn.  
*Coladenia dan*, Fabricius.  
*Sarangesa dasahara*, Moore.
143. ACHYRANTHES BIDENTATA, Blume.  
*Coladenia dan*, Fabricius.

Order CXXIII. ARISTOLOCHIACEÆ.

144. ARISTOLOCHIA BRACTEATA, Retz.  
*Papilio aristolochiæ*, Fabricius.
145. ARISTOLOCHIA INDICA, Linn.  
*Troides minos*, Cramer.  
*Papilio hector*, Linnæus.  
*Papilio aristolochiæ*, Fabricius.

Order CXXVIII. LAURINEÆ.

146. CINNAMOMUM ZEYLANICUM, Breyn. The wild cinnamon.  
*Cheritra jaffra*, Butler.  
*Papilio sarpedon teredon*, Felder.  
*Papilio clytia*, Linnæus.
147. ALSEODAPHNE SEMECARPIFOLIA, Nees.  
*Papilio sarpedon teredon*, Felder.  
*Papilio abrisa*, Kirby.  
*Papilio clytia*, Linnæus.
148. LITSEÆA TOMENTOSA, Herb.  
*Papilio clytia*, Linnæus.
149. LITSEÆA SEBIFERA, Pers.  
*Papilio sarpedon teredon*, Felder.  
*Papilio clytia*, Linnæus.



## Order CXXXII. LORANTHACEÆ.

150. LORANTHUS WALLICHIANUS, Schultz. All the plants of this Natural Order are often called 'Mistletoe' from the resemblance they bear to the European plant of that name.

*Tajuria cippus*, Fabricius.

151. LORANTHUS SCURRULA, Linn.

*Euthalia garuda*, Moore.

*Euthalia lubentina*, Cramer.

*Camena deva*, Moore.

*Creon cleobis*, Godart.

*Tajuria cippus*, Fabricius.

*Ops melastigma*, de Nicéville.

152. LORANTHUS TOMENTOSUS, Heyne.

*Camena deva*, Moore.

*Ops melastigma*, de Nicéville.

153. LORANTHUS LONGIFLORUS, Desrous.

*Castalius ananda*, de Nicéville.

*Zesius chrysomallus*, Hübner.

*Tajuria cippus*, Fabricius.

*Rathinda amor*, Fabricius.

*Delias eucharis*, Drury.

154. LORANTHUS ELASTICUS, Desrous.

*Creon cleobis*, Godart.

*Tajuria indra*, Moore.

*Tajuria cippus*, Fabricius.

## Order CXXXV. EUPHORBIACEÆ.

155. GLOCHIDION LANCEOLARIUM, Dalz.

*Athyma perius*, Linnæus.

156. GLOCHIDION ZEYLANICUM, A. Juss.

*Athyma inara*, Doubleday and Hewitson.

157. GLOCHIDION VELUTINUM, Wight.

*Athyma perius*, Linnæus.

*Athyma inara*, Doubleday and Hewitson.

158. HEMICYCLIA VENUSTA, Thwaites.

*Appias albina*, Boisduval.

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159. CROTON sp.  
*Rathinda amor*, Fabricius.
160. TREWIA NUDIFLORA, Linn.  
*Thaduka multicaudata*, Moore.
161. MALLOTUS PHILIPPINENSIS, Muell.  
*Coladenia indrani*, Moore.
162. TRAGIA INVOLUCRATA, Linn.  
*Ergolis taprobana*, Westwood.  
*Ergolis ariadne*, Linnæus.
163. TRAGIA INVOLUCRATA, var. CANNABINA, Linn.  
*Ergolis taprobana*, Westwood.  
*Ergolis ariadne*, Linnæus.  
*Byblia ilithyia*, Drury, in Khandeish and the Deccan in the Bombay Presidency.

## Order CXXXVI. URTICACEÆ.

164. CELTIS TETRANDBRA, Roxb.  
*Apatura (Rohana) camiba*, Moore.  
*Iabythea rama*, Moore.
165. TREMA ORIENTALIS, Blume.  
*Euripus consimilis*, Westwood.  
*Neptis kallaura*, Moore.  
*Neptis jumbah*, Moore.
166. STREBLIUS ASPER, Lour.  
*Euplœa (Crastia) core*, Cramer.  
*Euplœa (Pademina) kollari*, Felder.
167. FICUS BENGALENSIS, Linn. The banyan or 'bhor' tree.  
*Euplœa (Crastia) core*, Cramer.  
*Cyrestis thyodamas*, Boisduval.  
*Iraota timoleon*, Stoll.
168. FICUS INDICA, Linn.  
*Cyrestis thyodamas*, Boisduval.  
*Iraota timoleon*, Stoll.

169. *FICUS RELIGIOSA*, Linn. The pipal.  
*Euploea (Crastia) core*, Cramer.
170. *FICUS GLOMERATA*, Roxb.  
*Euploea (Crastia) core*, Cramer.  
*Cyrestis thyodamas*, Boisduval.  
*Iraota timoleon*, Stoll.
171. *FLEURYA INTERRUPTA*, Gaud. A kind of nettle.  
*Hypolimnas bolina*, Linnæus.
172. *ELATOSTEMA CUNEATUM*, Wight.  
*Hypolimnas bolina*, Linnæus.

## Order CXLVIII. ORCHIDEÆ.

173. *RHYNCHOSTYLIS RETUSA*, Blume.  
*Chliaria othona*, Hewitson.
174. *SACCOLABIUM PAPILLOSUM*, Lindl.  
*Chliaria othona*, Hewitson.

## Order CXLIX. SCITAMINEÆ.

175. *CURCUMA AMADA*, Roxb. Wild turmeric.  
*Udaspes folus*, Cramer.  
*Notocrypta feisthamelii*, Boisduval.
176. *KEMPFERIA PANDURATA*, Roxb.  
*Lampides elpis*, Godart.  
*Udaspes folus*, Cramer.
177. *HEDYCHIUM CORONARIUM*, Kœnig.  
*Lampides elpis*, Godart.  
*Udaspes folus*, Cramer.  
*Notocrypta feisthamelii*, Boisduval.
178. *AMOMUM MICROSTEPHANUM*, Baker.  
*Lampides elpis*, Godart.  
*Udaspes folus*, Cramer.  
*Notocrypta feisthamelii*, Boisduval.  
*Sancus pulligo*, Mabille.

179. *ELETTARIA CARDAMOMUM*, Maton. The cardamon.  
*Lampides elpis*, Godart.

Order CLIV. *DIOSCOREACEÆ.*

180. *DIOSCOREA PENTAPHYLLA*, Linn.  
*Aphnæus lohita*, Horsfield.  
*Loxura atymnus*, Cramer.  
*Tagiades atticus*, Fabricius.  
*Tagiades obscurus*, Mabille.

Order CLVI. *LILIACEÆ.*

181. *SMILAX MACROPHYLLA*, Roxb.  
*Loxura atymnus*, Cramer.  
*Tagiades atticus*, Fabricius.

Order CLXIII. *PALMEÆ.*

182. *ARECA CATECHU*, Linn. The Supari or Betel-nut.  
*Elymnias caudata*, Butler.  
*Gangara thyrsis*, Fabricius.  
*Suastus gremius*, Fabricius.

183. *CARYOTA URENS*, Linn. The Palmyra or fan palm.  
*Elymnias caudata*, Butler.  
*Gangara thyrsis*, Fabricius.  
*Suastus gremius*, Fabricius.

184. *PHENIX SYLVESTRIS*, Roxb. Wild date palm.  
*Elymnias caudata*, Butler.  
*Gangara thyrsis*, Fabricius.  
*Suastus gremius*, Fabricius.  
*Hyarotis adrastus*, Cramer.

185. *CALAMUS PSEUDO-TENUIS*, Becc. and Hook. f. Rattan or cane.  
*Elymnias caudata*, Butler.  
*Gangara thyrsis*, Fabricius.  
*Suastus gremius*, Fabricius.  
*Pedestes submaculata*, Standinger.  
*Hyarotis adrastus*, Cramer.

186. *COCOS NUCIFERA*, Linn. Coconut palm.  
*Elymnias caudata*, Butler.

*Gangara thyrasis*, Fabricius.

*Suastus gremius*, Fabricius.

Order CLXXIII. GRAMINEÆ.

187. *ORYZA SATIVA*, Linn. Rice.

*Mycalesis (Orsotrisæna) mandata*, Moore.

*Mycalesis (Calysisme) visala*, Moore.

*Mycalesis (Nissanga) junonia*, Butler.

*Ypthima baldus*, Fabricius.

*Melanitis ismene*, Cramer.

*Baoris (Parnara) guttatus*, Bremer and Grey.

*Ampittia dioscorides*, Fabricius.

*Baoris (Parnara) bevani*, Moore.

*Baoris (Chapra) subochracea*, Moore

*Baoris (Chapra) mathias*, Fabricius.

188. *ZEA MAYS*, Linn. Maize or Indian corn.

*Baoris (Parnara) conjuncta*, Herrich-Schäffer.

189. Grasses of different kinds.

*Mycalesis (Orsotrisæna) mandata*, Moore.

*Mycalesis (Calysisme) perseus*, Fabricius.

*Mycalesis (Calysisme) visala*, Moore.

*Mycalesis (Nissanga) junonia*, Butler.

*Ypthima baldus*, Fabricius.

*Ypthima huebneri*, Kirby.

*Melanitis ismene*, Cramer.

*Melanitis varaha*, Moore.

*Iambrix salsala*, Moore.

*Baoris (Parnara) guttatus*, Bremer and Grey.

*Baracus hamptoni*, Elwes and Edwards.

*Taractrocera ceramas*, Hewitson.

*Ampittia dioscorides*, Fabricius.

*Æromachus indistinctus*, Moore.

*Padraona gola*, Moore.

*Baoris (Parnara) conjuncta*, Herrich-Schäffer.

*Baoris (Parnara) colaca*, Moore.

*Baoris (Chapra) subochracea*, Moore.

*Baoris (Chapra) mathias*, Fabricius.

190. *BAMBUSA ARUNDINACEA*, Willd. Bamboo.

*Lethe europa*, Fabricius.

*Lethe drypetis*, Hewitson.  
*Melanitis gokala*, Moore.  
*Discophora lepida*, Moore.  
*Matapa aria*, Moore.  
*Padraona dara*, Kollar.  
*Iambrix salsala*, Moore.  
*Halpe ceylonica*, Moore.  
*Telicota bambusæ*, Moore.  
*Baoris oceia*, Hewitson.  
*Baoris (Parnara) kumara*, Moore

191. BAMBUSA sp.  
*Discophora indica*, Staudinger.  
*Baoris (Parnara) philippina*, Herrich-Schäffer.

192. OXYTENANTHERA MONOSTIGMA, Beddome.  
*Discophora lepida*, Moore.  
*Padraona dara*, Kollar.  
*Halpe ceylonica*, Moore.  
*Halpe hyrtacus*, de Nicéville.  
*Telicota bambusæ*, Moore.

193. DENDROCALAMUS STRICTUS, Nees.  
*Discophora lepida*, Moore.  
*Matapa aria*, Moore.  
*Halpe honorei*, de Nicéville.  
*Baoris oceia*, Hewitson.

194. OCHLANDRA STRIDULA, Thwaites.  
*Zipoetes saitis*, Hewitson.  
*Discophora lepida*, Moore.  
*Matapa aria*, Moore.  
*Padraona dara*, Kollar.  
*Halpe hyrtacus*, de Nicéville.  
*Baoris oceia*, Hewitson.  
*Baoris (Parnara) kumara*, Moore.

*Plants from the Western Himalayas and Kashmir, with the species of butterflies whose larvæ feed on them.*

#### Order L. LEGUMINOSÆ.

1. INDIGOFERA ATROPURPUREA, Hamilt.  
*Thecla sassanides*, Kollar.  
*Hysudra selira*, Moore.

## Order LXXVIII. COMPOSITÆ.

2. *CARDUUS* sp.*Vanessa cardui*, Linnæus.

## Order CXXXVI. URTICACEÆ.

3. *URTICA PARVIFLORA*, Roxb.*Vanessa caschmirensis*, Kollar.

## Order CXLI. SALICINÆ.

4. *SALIX TETRASPERMA*, Roxb.*Vanessa xanthomelas*, Wiener Verzeichniss.

## PART II.

*A Revised List of the Butterflies of the Kanara District arranged in the order of Messrs. Davidson, Bell and Aitken's previous papers, with the names of the Food-plants on which the larvæ feed.*

## Family NYMPHALIDÆ.

## Subfamily DANAINÆ.

1. *HESTIA MALABARICA*, Moore.*Aganospma cymosa*, G. Don (*Apocynaceæ*).

*H. lynceus*, Drury, of the previous list, p. 239, is a species restricted by Dr. F. Moore in *Lep. Ind.*, vol. i, p. 26 (1890), to Borneo. It has the wings much longer and narrower and the coloration much darker than our South Indian species. Dr. Moore (*l.c.*, p. 18) does not record *H. malabarica* from Kanara, but it undoubtedly occurs there. But he describes (*l.c.*, p. 21, pl. ii, figs. 2, *male*; 2a, *female*; 1, *larva*; 1a, *pupa*) *H. kanarensis* as a new species from North Kanara and the South Konkan. It is a smaller species than *H. malabarica*, 4·25 to 4·75 as against 5·0 to 5·5 inches in expanse. "The markings similarly disposed and shaped but smaller, being about half the size of those in *H. malabarica*." This latter remark is an obvious exaggeration speaking of the markings as a whole, as can be verified by comparing Dr. Moore's figures of the two species in *Lep. Ind.* I do not think that *H. kanarensis* can be retained as a species distinct from *H. malabarica*. Its smaller size is its most distinctive character.

2. DANAIS (*Parantica*) AGLÆA, Cramer.  
*Cryptolepis Buchanani*, Roem. and Sch. (*Asclepiadææ*).  
*Tylophora tenuis*, Blume\* (*Asclepiadææ*).

3. DANAIS (*Tirumala*) LIMNIACE, Cramer.  
*Dregea volubilis*, Benth.† (*Asclepiadææ*).

4. DANAIS (*Tirumala*) SEPTENTRIONIS, Butler.  
*Dregea volubilis*, Benth. (*Asclepiadææ*).

Not recorded from Kanara in the lists, but undoubtedly occurs in the district according to Mr. Bell, who says he has specimens of it which agree with the typical form both in coloration and markings. Specimens intermediate between *D. limniace*, Cramer, and *D. septentrionis* also occur, and for these Mr. Aitken in the first paper (p. 266) suggested in joke the name *D. limnitritionis*. Mr. Fruhstorfer has probably described this form as *Tirumala melissa dravidarum* in Berl. Ent. Zeitsch., vol. xlv, p. 113 (1899).

5. DANAIS (*Limnas*) CHRYSIPPUS, Linnæus.  
*Calotropis gigantea*, Br. (*Asclepiadææ*).  
*Asclepius Curassavica*, Linn. (*Asclepiadææ*).

6. DANAIS (*Sulatura*) PLEXIPPUS, Linnæus.

The *D. genutia*, Cramer, of the previous list, p. 240, but Linnæus' name undoubtedly applies to this species. It has often been bred in Kanara; the larva feeds on an asclepiad, which has not been identified.

7. EUPLÆA (*Crustia*) CORE, Cramer.  
*Holarrhena antidysenterica*, Wall. (*Apocynacææ*).  
*Nerium odorum*, Soland. (*Apocynacææ*).  
*Ichnocarpus frutescens*, Br. (*Apocynacææ*).  
*Streblus asper*, Lour. (*Urticacææ*).  
*Ficus bengalensis*, Linn. (*Urticacææ*).  
*Ficus religiosa*, Linn. (*Urticacææ*).  
*Ficus glomerata*, Roxb. (*Urticacææ*).

8. EUPLÆA (*Pudemma*) KOLLARI, Felder.

*Streblus asper*, Lour. (*Urticacææ*).

The larva is said to also feed "On several species of *Ficus*."

\* The *Tylophora carnosus*, Wall., of the first paper, p. 266, is a synonym of *T. tenuis*, Blume.

† The *Hoya viridiflora*, Br., of the first paper, p. 266, is a synonym of *Dregea volubilis*, Benth.



9. *EUPLEA (Narmada) CORETA*; Godart.*Ichnocarpus frutescens*, Br. (*Apocynaceæ*).

LARVA. The larva is of the type of that of *Euplœa (Crastia) core*, Cramer, except that the subdorsal tentacles are wanting on segment 6, and the two pairs on segments 3 and 4 are considerably longer. The head is round, smooth, shiny and black, with a narrow white band round the margin over the vertex, and a similar band down each side of the clypeus meeting at the apex of the clypeus; the labrum is white. The surface of the body is smooth and rather greasy looking. The spiracles are oval, black and shiny. The colour of the body varies somewhat, or rather the shade varies; segments 3 and 4 are dorsally always slightly yellowish. There is always a dark bluish, dorsal line or band. The general colour of the body is a light violet-green on the somites of the dorsal half, and a chocolate-green on the somites of the ventral half; there is a subspiracular yellow line dividing the two colours; a slight yellow shade around the spiracles, and the extreme base of all three pairs of tentacles is yellow; segment 2 is light yellow with a black subdorsal shiny spot, and the anal flap is yellow, with a very large shiny black mark, covering nearly three-fourths of the dorsum; tentacles dull indigo in colour; all the legs shiny black. Length 39 mm., breadth 6 mm., length of tentacles of segment 3 is 14 mm., of segment 4 is 9 mm., of segment 12 is 6 mm. All the tentacles are nearly straight.

PUPA. The pupa has nothing in any way to distinguish it in shape from that of *E. core*. The spiracles are light brown, oval, of the usual size. The colour of the pupa is silver, with one very broad subdorsal, and one very broad, spiracular, lightish brown band on the abdomen meeting on segment 6, which is entirely brown, as are also segments 4 and 5 except dorsally; the shoulders and the inner margin of the wing are broadly brown, as is also the vortex of the head; there is a narrow brown band along the outer margin of the wings; a broad, dorsal, thoracic, brown band forking from the apex to the hinder margin; a large, oblong, brown mark on the wing beyond the discoidal cell; the cremaster is strong, triangular, flattened dorsally and ventrally, with a rugose knob at the end, and a spherical tubercle at the base laterally: all shiny black, as are also the anal clasper scars; the costal margins of the wings and the haustellum are also brownish; the whole surface is shiny and quite smooth. Length 18.5 mm. including the cremaster, breadth at segment 7 is 8.5 mm., which is the broadest part.

HABITS. The habits are the same as those of *E. core* in every particular. The larva eats the young leaves, living on the underside of the leaves. It pupates under a leaf, hanging very freely. The larva is badly persecuted by ichneumons.

## Subfamily SATYRINÆ.

10. MYCALESIS (*Orsotriæna*) MANDATA, Moore.*Oryza sativa*, Linn. (*Graminææ*).Grasses (*Graminææ*).11. MYCALESIS (*Calysisme*) PERSEUS, Fabricius.Grasses (*Graminææ*).

Recorded without a number in the second Kanara paper, p. 242.

12. MYCALESIS (*Calysisme*) VISALA, Moore.*Oryza sativa*, Linn. (*Graminææ*).Grasses (*Graminææ*).

This appears in the Kanara papers as *M. mineus*, Linnæus, a species now restricted by Dr. F. Moore to N. and E. India, Burma, Siam, and S.-E. China.

13. MYCALESIS (*Calysisme*) SUBDITA, Moore.

Not recorded in the Kanara papers, but Mr. Bell caught it in one place, Tarimalapur, up the valley of the Kalinaddi river. Dr. Moore restricts it to South India and Ceylon. It has not been bred in the Kanara district.

14. MYCALESIS (*Nissanga*) JUNONIA, Butler.*Oryza sativa*, Linn. (*Graminææ*).Grasses (*Graminææ*).

## 15. LETHE EUROPA, Fabricius.

*Bambusa arundinacea*, Willd. (*Graminææ*).

## 16. LETHE DRYPETIS, Hewitson.

*Bambusa arundinacea*, Willd. (*Graminææ*).

The *L. drypetes* [sic] of Moore's "Lep. Ind.," and *L. todara*, Moore, of the second Kanara paper, p. 243, that species being a synonym of *L. drypetis*.

## 17. LETHE NEELGHERRIENSIS, Guérin.

The *L. neelgheriensis* [sic] of Moore's "Lep. Ind." It has not been bred in Kanara, but the imago is found above the ghâts in Haliyal and on the Dharwar frontier. In Ceylon the larva is said to feed on grasses.

## 18. YPETHIMA BALDUS, Fabricius.

*Oryza sativa*, Linn. (*Graminææ*).

Grasses (*Gramineæ*).

The *Y. philomela*, Johanssen, of the second Kanara paper. It is quite possible that the true *Y. philomela*, Johanssen (I do not know what the *Y. philomela* of Linnæus is) may also occur in Kanara, as I have specimens from the Nilgiri Hills, the Wynaad (type of *Y. tabella*, Marshall), as well as from Henzada and Manlin in Burma. Dr. F. Moore in "Lep. Ind." restricts *Y. philomela*, Johansson [sic], to Java and Sumatra, and gives *Y. tabella* full specific rank, recording it from South India and Burma. In Lep. Ind., vol. ii, p. 58, he defines *Thymipa*, the genus in which he places *Ypthima philomela*, as having a prominent androconial patch in the male, while in describing *Thymipa tabella*, p. 73, he says it has "No glandular patch nor androconia." As a matter of fact the patch is sometimes absent, sometimes faintly present, and sometimes prominent, especially so in specimens from Java and Bali. In Sumatran specimens it is faint, in Burmese and South Indian examples apparently entirely absent.

## 19. YPTHIMA HUEBNERI, Kirby.

Grasses (*Gramineæ*).

Some Kanarese examples of this species have pure white cilia to the hindwing, while others have the outer half of the disc of the hindwing on the upperside suffused with white, thereby approximating in coloration to *Y. ceylonica*, Hewitson.

## 20. ZIPÆTES SAITIS, Hewitson.

*Ochlandra stridula*, Thwaites (*Gramineæ*).

## 21. MELANITIS ISMENE, Cramer.

*Oryza sativa*, Linn. (*Gramineæ*).Grasses (*Gramineæ*).

The *M. leda*, Linnæus, of the first Kanara paper, p. 267.

## 22. MELANITIS VARAHA, Moore.

Grasses (*Gramineæ*).

Colonel C. Swinhoe's *Melanitis ampa*, described in Ann. and Mag. of Nat. Hist., sixth series, vol. v, p. 353, n. 1 (1890) from North Kanara, July, is a wet-season form of *M. varaha*.

## 23. MELANITIS GOKALA, Moore.

*Bambusa arundinacea*, Willd. (*Gramineæ*).

## Subfamily ELYMNIINÆ.

24. ELYMNIAS CAUDATA, Butler.  
*Areca Catechu*, Linn. (*Palmææ*).  
*Caryota urens*, Linn. (*Palmææ*).  
*Phoenix sylvestris*, Roxb. (*Palmææ*).  
*Calamus pseudo-tenuis*, Becc. and Hook. f. (*Palmææ*).  
*Cocos nucifera*, Linn. (*Palmææ*).

## Subfamily AMATHUSIINÆ.

25. DISCOPHORA LEPIDA, Moore.  
*Bambusa arundinacea*, Willd. (*Graminææ*).  
*Oxytenanthera monostigma*, Beddome (*Graminææ*).  
*Dendrocalamus strictus*, Nees (*Graminææ*).  
*Ochlandra stridula*, Thwaites (*Graminææ*).

26. DISCOPHORA INDICA, Standinger.  
 Bamboos (*Graminææ*).  
 This is a new record from Kanara.

LARVA. The larva is similar in shape and appearance to that of *D. lepida*, Moore. Head semi-elliptic, as seen from the front; clypeus black with a central white line, and bordered all round with yellowish; a narrow yellow line from over the vertex of the head down the middle of the face to the apex of the clypeus; eyes black; a bunch of long porrect hairs on the top of each lobe of the head; porrect hairs disposed moderately densely also down both cheeks; colour of the head red-brown, appearing lighter on the vertex of each lobe because of the light-coloured bunches of hair; surface dull. Spiracles oval, black, with white centres. Surface of the body dull, covered all over moderately densely with longish erect hairs of which some few laterally are longer than the rest; there is a subdorsal bunch of spine-like hairs on segments 3 to 6, making these segments look brown over the dorsum; the other hairs are light mouse-coloured. Anal flap broadly rounded at the extremity, the two anal processes beneath it are short, conical, light yellow and hairy. Colour of the body light brownish-greyish, with a thin subdorsal white line (not a broad white dorsal band as in *D. lepida*); each segment with a latero-dorsal black mark near the front margin, which mark is very distinct on segments 2 to 7, and hardly perceptible on the rest; behind the black marks on segments 2 to 13 is a large light chocolate-brown mark or patch; legs rose-coloured. Size somewhat smaller than *D. lepida*.

PUPA. The pupa is in every way the same as that of *D. lepida*, and

only differs from it in being smaller than the majority of pupæ of that species. In shade it is either bone-coloured or green according to whether it has been formed among dead leaves, &c., or green leaves; when green the edges of the pupa along the wings are yellow as in *D. lepida*, but when bone-coloured the black spots sprinkled over the surface in *D. lepida* are not present here; the surface of the two contiguous head-points is also shiny, while in *D. lepida* it is dullish.

HABITS. In habits the larvæ and pupæ differ in no way from those of *D. lepida*. The larva, as is also the case in *D. lepida*, will suspend itself by the tail against a perpendicular surface with its ventral surface towards the perpendicular surface, and, when pupating, will turn itself round, so that, when the pupa is formed, the dorsal surface of the pupa will rest against the perpendicular surface.

#### Subfamily ACREINÆ.

##### 27. TELCHINIA VIOLE, Fabricius.

*Modecca palmata*, Lam. (*Passifloræ*).

#### Subfamily NYMPHALINÆ.

##### 28. ERGOLIS TAPROBANA, Westwood.

*Tragia involucrata*, Linn. (*Euphorbiacæ*).

*Tragia involucrata*, var. *cannabina*, Linn. (*Euphorbiacæ*).

##### 29. ERGOLIS ARIADNE, Linnæus.

*Tragia involucrata*, Linn. (*Euphorbiacæ*).

*Tragia involucrata*, var. *cannabina*, Linn. (*Euphorbiacæ*).

In Guzerat in the Bombay Presidency it has been bred on *Tragia cannabina*, Linn., which is given by Hooker as a var. of *T. involucrata*.

##### 30. BYBLIA ILITHYIA, Drury.

This species has been bred in Khandeish and the Deccan, both in the Bombay Presidency, on *Tragia involucrata*, Linn., var. *cannabina*, Linn. (*Euphorbiacæ*). It has not been bred in the Kanara District itself. There is a very interesting paper in Ann. and Mag. of Nat. Hist., sixth series, vol. xviii, p. 333 (1896) by Mr. Guy A. K. Marshall, entitled "Notes on the Genus *Byblia* (= *Hypanis*)," in which he notes that he is convinced "That all the Asiatic and continental African forms of *Byblia* are referable to a single species." Dr. Chr. Aurivillius in Kongl. Svens. Vet.-Akad. Handl., vol. xxxi, n. 5, p. 158 (1898), records *B. ilithyia*, Drury, from Africa, the Cape Verde Islands, Arabia

and India, and *B. goetzius*, Herbst, from Africa only, giving a woodcut of the upperside of the forewing of each to allow of their easy identification.

31. EURIPUS CONSIMILIS, Westwood.

*Trema orientalis*, Blume (*Urticacess*).

EGG. The egg is green, shiny, and spherical in shape, though slightly higher than broad, and has twenty-two prominent ridges from top to bottom, all parallel to each other in the manner of meridional lines: these ridges merge into the level of the surface of the egg towards its top. The breadth is 1.3 mm.

LARVA. The larva is of the type of *Ergolis*, but has no spines on the body. Body cylindrical, thickest in the middle, and gradually decreasing in width to the very narrow hinder end, which terminates in two nearly parallel, conical processes about 2 mm. in length bearing short hairs; the body also decreases from the middle of segment 2 (where it is about the same breadth as at segment 11/12). The head is nearly square, slightly higher than broad however; the face almost flat, and each lobe is surmounted by a stout cylindrical process or horn, which horn is slightly longer than the head is high; it has three or four short, yellow spines before the middle, and is shortly bifurcated at the top; the front face of the horn is nearly in the same plane as the face; these two horns diverge at an angle of about 35°, and are rather widely and squarely separated at the base; on the hind vertex of the head between the horns are two small conical red-brown spines; along the side margin of the head in continuation with the outside edge of the horn are three sharp spines; the surface of the head is otherwise smooth and shiny; the colour of the head is dark green, with a long narrow white clypeus, a white band from the base of each horn running down each side of the central line of the face and along the sides of the clypeus to the jaws, as also a white band on each cheek separating the face from the cheek; the horn-spines and the two vertex spines are tipped with black: the head is higher than segment 2 but about the same breadth. The surface of the body is dull and rough, each segment being set with seven transverse rows of minute, conical, yellow tubercles; the colour of the body is dark green with a red spot in the spiracular region of segments 3, 7, 10, and 12/13, those on segments 7 and 10 being larger than the other two; the yellow tubercles are each surmounted by a short hair; there is a small brown spot or two next each spiracle. Spiracles flush, oval, rather large, light green, with a very narrow, shiny black border, and a central thin white slit. Length 42 mm. altogether, breadth 7 mm., length of horn 5 mm., breadth of head 4 mm. The breadth across the base of the anal

processes or points (that is the breadth of the larva at that base) is about 1.5 mm.

**PUPA.** The pupa is similar to that of *Apatura (Rohana) camiba*, Moore, in general facies and mode of suspension. Looked at sideways the pupa is a section of a circle: about a quarter moon-crescent, the ventral line being nearly straight, and the dorsal line highly and evenly curved, the abdominal segments being much compressed laterally and highly carinated in the dorsal line, the edge of the carination being sharp, *i.e.*, thin. The pupa is the same breadth from the shoulders to segment 8, and is in the middle twice as high as broad; segments 4, 5 and 6 are separated slightly in the dorsal carinated edge, and segment 6 is the highest part of the carination; the transverse dorsal section in the middle is pear-shaped, the same section across the ventrum from spiracle to spiracle being a compressed semicircle; the head has two strong, slightly diverging, conical processes, narrowly separated at the base and about 1.5 mm. in length: these head-points are about half as far apart at the tips as the pupa is broad in the middle: the pupa increases evenly in width to the shoulders, which have each two small smooth tubercles; the thorax is convex transversely; the cremaster is stout, triangular, flattened above and below. The surface of the pupa is dull, and is transversely wrinkled all over as seen under a lens; there is a low indistinct ridge from each head-point running back on to the thorax, and the wing-edge is a ridge from the shoulder to segment 4. The spiracles are depressed, oval, and the colour of the pupa. The pupa is green, densely streaked with white on the thorax and head, more obscurely on the rest of the surface; the dorsal ridge and wing-edge ridge is yellowish; and there is a rather prominent brown-yellow rugosity on the spiracular line at the hinder margin of segment 7. Length 29 mm. over all, height at middle 12 mm., breadth at middle over 8 mm.

**HABITS.** The egg is laid on the upperside of the leaf, or near the edge on the underside. The larva, on emerging, eats the egg-shell partially, and then makes a bed of silk anywhere on the upperside of the leaf. Having grown somewhat it betakes itself to the middle of the leaf and lies along the midrib near the point, covering the surface of the leaf with a thick carpet of silk; over this carpet it weaves a network of silk which is free of the surface of the leaf, and on the top of this network the larva rests with its face in the same plane as the ventral surface, so that the horns are resting on the web. When about to pupate the larva wanders, and finally finishes up on the under surface of some leaf, where it undergoes its transformation. The pupa is stoutly attached by the tail only, so that the ventral surface is parallel to the under surface of the leaf.

## 32. CUPHA PLACIDA, Moore.

*Flacourtia montana*, Grah. (*Bixineæ*).

Heir H. Fruhstorfer in Berl. Ent. Zeitsch., vol. xliii, p. 198 (1898), has named this species *C. erymanthis maja* from Karwar in North Kanara.

## 33. ATELLA PHALANTHA, Drury.

*Flacourtia montana*, Grah. (*Bixineæ*).

## 34. ATELLA ALCIPPE, Cramer.

*Alsodeia zeylanica*, Thwaites (*Violaceæ*).

In the second paper; p. 248, it is noted that the larva was found "On a tree, which we believe to be a very local species of *Hydnocarpus* [*Bixineæ*, the Natural Order which next follows the *Violaceæ*], but this requires verification." This identification is incorrect, the food-plant being *Alsodeia zeylanica*.

## 35. CETHOSIA MAHRATTA, Moore.

*Modecca palmata*, Lam. (*Passifloreæ*).

## 36. CYNTHIA SALOMA, de Nicéville.

*Modecca palmata*, Lam. (*Passifloreæ*).37. APATURA (*Rohana*) CAMIBA, Moore.*Celtis tetrandra*, Roxb. (*Urticaceæ*).

Dr. F. Moore in Lep. Ind., vol. iii, p. 3 (1896), gives the genus *Aputura* (part), Fabricius, as a synonym of *Potamis*, Hübner. He uses *Aputura* for the species placed in this paper under *Hypolimnas*, Hübner.

## 38. PRECIS IPHITA, Cramer.

*Strobilanthes callosus*, Nees (*Acanthaceæ*).

Dr. F. Moore in Lep. Ind., vol. iv, p. 62 (1899) notes that this species is not a true *Precis*, the type of that genus being the *Papilio octavia* of Cramer, an African species, which has the discoidal cell of the forewing closed, while *Junonia* (in which *iphita* is best placed) has it open. Dr. Chr. Aurivillius in Kongl. Svens. Vet.-Akad. Hand., vol. xxxi, n. 5, p. 131 (1898), gives *Junonia* as a synonym of *Precis*, the latter being the older name. Dr. A. G. Butler in Ann. and Mag. of Nat. Hist., seventh series, vol. iv, p. 373 (1899), notes that "Prof. Aurivillius shows that *Precis* has priority over *Junonia*; therefore, although the latter is a far more satisfactory name for the genus (became more descriptive), I suppose it will have to go."



39. *PRECIS ALMANA*, Linnæus.*Hygrophila spinosa*, T. Anders. (*Acanthaceæ*).

Mr. Bell notes that the larva feeds on some other unidentified acanthads. In the first paper, p. 272, *Asteracantha longifolia*, Nees\* (*Acanthaceæ*), and *Lippia nodiflora*, Rich. (*Verbenaceæ*) are recorded: the latter food-plant Mr. Bell considers to be doubtful.

40. *PRECIS LEMONIAS*, Linnæus.*Nelsonia campestris*, Br. (*Acanthaceæ*).*Hygrophila spinosa*, T. Anders. (*Acanthaceæ*).*Strobilanthes callosus*, Nees (*Acanthaceæ*).*Barleria Prionitis*, Linn. (*Acanthaceæ*).41. *PRECIS HIERTA*, Fabricius.*Hygrophila spinosa*, T. Anders. (*Acanthaceæ*).? *Barleria* sp. (*Acanthaceæ*).42. *PRECIS ORITHYIA*, Linnæus.*Hygrophila spinosa*, T. Anders. (*Acanthaceæ*).43. *PRECIS ATLITES*, Linnæus.*Hygrophila spinosa*, T. Anders. (*Acanthaceæ*).*Barleria* sp. (*Acanthaceæ*).

**Egg.** The egg is barrel-shaped, there being thirteen longitudinal ridges from top to bottom, parallel to each other, and not continued on to the flat top; these ridges under the lens are finely beaded and are thin, being one-fifth as broad as the interspace at the middle of the egg; the flattish top of the egg has a small white ring in the centre—the micropyle; the surface of the egg is shiny and smooth; the colour is dark green with all the ridges white.

**LARVA.** The larva resembles in shape those of the larvæ of all the species of *Precis* found in the Kanara district, and the disposition of the spinous processes is the same. There are two such processes, one above the other, on segment 2 below the spiracle on the base of the leg; two in a horizontal line on the base of the legs of segments 3 and 4; a triangle of three on segments 5 and 6 where the leg would be were there one; two in a horizontal line above and one below, and two in a line on the base of the proleg of segments 7 to 10; two, one below the other, on segment 11; one subspiracular on segments 3 to 12; all except the subspiracular ones dirty watery-white in colour, and set with

\* *Asteracantha* is given by Hooker as a subgenus of *Hygrophila*, and *longifolia* Nees, as a synonym of *Hygrophila spinosa*, T. Anders,

fine white hairs as long as the processes in the subspiracular line, these subspiracular spines being one-fourth as long again as the ones beneath that line; besides these processes there are also the following:—a dorsal, dorso-lateral, and supra-spiracular process on segments 5 to 11; on segments 3 and 4 a dorso-lateral and supra-spiracular process; on segments 13 and 14 a dorso-lateral process; on segment 12 two dorsal processes, one in front of the other, as well as a dorso-lateral and supra-spiracular process; all these processes from the subspiracular ones upwards are of the same length, shiny blackish in colour, set with two whorls of dark yellow-brown spinelets nearly as long as the processes; the processes are just under 2 mm. in length; segment 2 has ten simple, slightly-curved, spinous hairs along the front margin, black and rather long; the surface of the body is covered besides, (and herein lies its difference from other larvæ of *Precis*), with 1 mm. long fine pure white hairs, each hair springing from a minute circular pure white tubercle; a narrow dorsal line and the whole of the dorsum of segment 3 have no white hairs. The anal flap is nearly semicircular in outline and somewhat thickened at the extremity, where it is yellow-ochreous in colour. The spiracles are oval, black, with shiny black borders. Head rather small, squarish, with the vertex indented, giving an appearance of being bilobed; the vertex of each lobe bears a conical, shining, ochreous tubercle surrounded by three or four small ones each bearing a hair, the hair of the large tubercle always long and white; another small tubercle in the middle of each lobe; some stiff black hairs on the upper part of the face, some soft white hairs about the base; colour of the head dark bronzy-blackish-brown, with a rather large triangular black clypeus; colourless labrum; ochreous basal antennal joint, and blackish second joint. Neck dull greenish-black. Colour of body velvety black, looking, under the lens, slightly shiny greenish-black; the abdomen lighter blackish; a subspiracular band, sending a short shoot up and forwards before each spiracle, legs and prolegs, all brownish-ochreous. The whole larva appears frosted with white on account of the presence of the small white hairs. Length 40 mm., breadth 5 mm.

**PUPA.** The pupa is almost exactly the same shape as that of *Precis almana*, Linnæus, in every way; it differs mainly in the colour, which is a dull light brown throughout, with the front faces of the tubercles slightly darker, and the hinder faces somewhat lighter, than the colour of the body; the head-points, the apex of the thorax, and the sides of the cremaster, dark brown; the hinder half of segment 8 lighter than the body; the apex of the thorax is more pointed than that of *P. almana*, the apex being a conical point; the head-points are much more pronounced, being conical; the front slope from the apex of the

thorax to the front of the pupa is straight, instead of convex as in *P. almana*; the cremaster is smoothly-triangular, and has no tubercles; the whole pupa is slighter. Spiracles of segment 2 indicated by a small semicircle of a light red-brown colour on the surface of segment 3; the other spiracles are narrowish, black, somewhat raised ovals. Length 17.5 mm., breadth 6.25 mm. at the shoulders and at segment 8; between these points the pupa is somewhat constricted.

**HABITS.** The egg is laid on a stalk of grass, on the dead stem of any plant, in fact anywhere; the larva on emergence easily finds its food-plant, which generally grows in great abundance all around; it lies on the underside of the leaves and low down on the plant, drops to the ground curled up when touched, and remains a long time thus. The food-plant grows chiefly in damp places and always in great quantities. The pupa as a rule is affixed to a stem or leaf in some thick place, and, like the larva, is not easy to find. The butterfly is hardly ever found in jungle, but is very plentiful along the coast in open cultivation, especially about rice fields and on the banks of tanks or ponds.

44. **NEPTIS (Rahinda) HORDONIA**, Stoll.

*Cæsalpinia mimosoides*, Lam. (*Leguminosæ*).

*Acacia Intsia*, Willd. (*Leguminosæ*). Form of larva with short processes.

*Acacia pennata*, Willd. (*Leguminosæ*). Form of larva with long processes.

The form of *N. hordonia* with short processes in the larva is said to feed also on "Several species of *Albizia*" (*Leguminosæ*).

45. **NEPTIS VIRAJA**, Moore.

*Dalbergia latifolia*, Roxb. (*Leguminosæ*).

*Dalbergia volubilis*, Roxb.\* (*Leguminosæ*).

*Albizia Lebbek*, Benth. (*Leguminosæ*).

46. **NEPTIS VARMONA**, Moore.

Peas of several kinds (*Leguminosæ*).

The *N. leucothoë*, Cramer, of the second Kanara paper, p. 251, that species = *N. matuta*, Hübner, according to Dr. Moore, who restricts it to Java and Borneo.

47. **NEPTIS COLUMELLA**, Cramer.

The *N. ophiana*, Moore, of the second Kanara paper, which is a synonym of *N. columella*, Cramer. Though so widely-spread, this species

\* This food-plant has been wrongly identified—there is no such species—as *Dalbergia racemosa*, in the second Kanara paper, p. 251.

has never been bred, though Messrs. Davidson, Bell and Aitken once obtained eggs and young larva, but did not record the food-plant.

48. NEPTIS KALLAURA, Moore.

*Thespesia Lampas*, Dalz. and Gibs. (*Mulvaceæ*).

*Dalbergia confertiflora*, Benth. (*Leguminosæ*).

*Wagatea spicata*, Dalz. (*Leguminosæ*).

*Trema orientalis*, Blume (*Urticaceæ*).

LARVA. The larva is very similar to that of *N. jumbah*, Moore, except that it is furred-looking (minutely spined) all over. The processes are exactly the same as in *N. jumbah*, except that the subdorsal ones of segment 6 are shortly conical, and segments 7 and 8 have a small subdorsal tubercle, lacking in *N. jumbah*; all the processes are covered with cylindrical, rather long tubercles each bearing a rather long bristle in continuation; the head has the points on the vertex of each lobe rather more accentuated than in *N. jumbah*, and the surface is entirely covered with the same cylindrical hair-bearing tubercles as the rest of the body. The spiracles are roundly oval, broadly black-bordered, with light brown centres reaching from top to bottom, that is, the black border is thin at the top and the bottom. The arrangement of the coloration is exactly as in *N. jumbah*: it is very light brown-pink all over, including the head, except laterally on segments 9 to 14 where it is deep olive-moss-green strongly suffused with rusty orange, except along the borders, and a short dark moss-green diagonal line in the centre, of each segment 10 to 12; there is the merest tinge of the same olive-moss-green dorsally on segments 5 to 9, with a dorsal thin lighter line; the head has a thin dark border to the clypeus, and a slightly dark surface towards the vertex, which dark colour, however, is only visible between the light tubercles. Length 19 mm., breadth at middle 5.5 mm., the middle being the broadest part.

PUPA. The pupa is very like that of *N. jumbah*. The two conical head-points are wide apart, the points at the base of the antennæ (one at the base of each) are half the distance apart and about the same size, the point on the shoulder is small and sharp, the subdorsal conical tubercle on segment 6 is rather large; and there is a low, not accentuated, ridge from spiracle to spiracle on segment 7, which is slightly curved convexly towards segment 8; the thorax has a rather highly peaked, laterally flattened apex, and this apex is rounded in outline seen from the side, the hinder slope being at an angle of about 75° to the longitudinal axis of the pupa; the wing outline, that is the expansion outline (the inner margin of the forewing), is very highly curved: nearly a semicircle, and its apex rises to nearly the same height as the apex of

the thorax; the dorsal line of the abdomen is slightly toothed at the hinder margin of segments 8 to 11; the cremaster is triangular, with strong prominent waved sustensor ridges; the spiracles are rather small, oval, shiny and black. The colour of the pupa is always the same: a light fresh bone-colour with a brown-pink suffusion on the dorsal region of segments 10 to 12, a brown-gold streak along the ridge of segment 7, a brown-gold semicircle in front of the tubercles of segment 6 on the dorsum, and a similar streak along the hinder margin of the thorax; a large subdorsal mother-of-pearl gold patch on segment 4, a smaller one on segment 5, some gold at the base of the tubercle on segment 6, a silver-golden gleam on the sides of the thorax and on the whole wing-surface in certain lights, the whole of segment 2 silvery, a thin dorsal yellow line on the abdominal segments. Length 16 mm., breadth at segment 6 from apex to apex of wing expansion 8 mm., distance between head-points nearly 3.5 mm.

HABITS. The habits of the larva are the same as those of *N. jumbah* in every way. The pupa is of course suspended by the tail and hangs down perpendicularly, and is always attached to the underside of a leaf.

49. NEPTIS JUMBAH, Moore.

*Thespesia Lampas*, Dalz. and Gibs. (*Malvaceæ*).

*Kydia calycina*, Roxb. (*Malvaceæ*).

*Bombax malabaricum*, DC. (*Malvaceæ*).

*Helicteres Isora*, Linn. (*Sterculiaceæ*).

*Grewia Microcos*, Linn. (*Tiliaceæ*).

*Zizyphus Jujuba*, Lamk. (*Rhamnaceæ*).

*Zizyphus Xylopyrus*, Willd. (*Rhamnaceæ*).

*Zizyphus rugosa*, Lamk. (*Rhamnaceæ*).

*Millettia racemosa*, Benth. (*Leguminosæ*).

*Dalbergia latifolia*, Roxb. (*Leguminosæ*).

*Wagatea spicata*, Dalz. (*Leguminosæ*).

*Xylia dolabriformis*, Benth. (*Leguminosæ*).

*Trema orientalis*, Blume (*Urticaceæ*).

50. CIREHOCHROA THAIS, Fabricius.

*Hydnocarpus Wightiana*, Blume (*Biziniæ*).

51. HYPOLIMNAS BOLINA, Linnæus.

*Portulaca oleracea*, Linn. (*Portulacæ*).

*Fleurya interrupta*, Gaud. (*Urticaceæ*).

*Elatostema cuneatum*, Wight (*Urticaceæ*).

Dr. F. Moore in *Lep. Ind.*, vol. iv, p. 135 (1899), gives the genus *Hypolimnas*, Hübner, as a synonym of *Apatura*, Fabricius.

52. **HYPOLINNAS MISIPPUS**, Linnæus.  
*Portulaca oleracea*, Linn. (*Portulacæ*).
53. **PARTHENOS VIRENS**, Moore.  
*Zehneria umbellata*, Thwaites (*Cucurbitacæ*).
54. **LIMENITIS (Moduza) PROCRIS**, Cramer.  
*Stephegyne parvifolia*, Korth. (*Rubiaceæ*).  
*Wendlandia exserta*, DC. (*Rubiaceæ*).  
*Mussænda frondosa*, Linn. (*Rubiaceæ*).
55. **ATHYMA PERIUS**, Linnæus.  
*Glochidion lanceolarium*, Dalz. (*Euphorbiacæ*).  
*Glochidion velutinum*, Wight (*Euphorbiacæ*).
56. **ATHYMA RANGA**, Moore.  
*Linociera malabarica*, Wall. (*Oleaceæ*).  
*Olea dioica*, Roxb. (*Oleaceæ*).  
*Athyma ranga* and *A. mahesa*, both of Moore, being synonymous, the older name has to be used for this species. In the second Kanara paper, p. 254, it appears under the latter name.
57. **ATHYMA INARA**, Doubleday and Hewitson.  
*Wendlandia exserta*, DC. (*Rubiaceæ*).  
*Mussænda frondosa*, Linn. (*Rubiaceæ*).  
*Glochidion zeylanicum*, A. Juss. (*Euphorbiacæ*).  
*Glochidion velutinum*, Wight (*Euphorbiacæ*).
58. **ATHYMA SELENOPHORA**, Kollar.  
*Adina cordifolia*, Hook. f. (*Rubiaceæ*).
59. **SYMPHEDRA NAIS**, Forster.  
*Diospyros melanoxyton*, Roxb. (*Ebenacæ*).
60. **EUTHALIA (Dophla) LAUDABILIS**, Swinhoe.  
*Diospyros melanoxyton*, Roxb. (*Ebenacæ*).  
*Diospyros Candolleana*, Wight (*Ebenacæ*).
61. **EUTHALIA (Cynitia) LEPIDEA**, Butler.  
*Careya arborea*, Roxb. (*Myrtacæ*).  
*Melastoma malabathricum*, Linn. (*Melastomacæ*).
62. **EUTHALIA GARUDA**, Moore.  
*Mangifera indica*, Linn. (*Anacardiaceæ*).

*Anacardium occidentale*, Linn. (*Anacardiaceæ*).

*Loranthus scurrula*, Linn. (*Loranthaceæ*).

"Larva commonly feeds on the mango and cashewnut tree, also on the mulberry and the rose, and on *Loranthus*" (First Kanara paper, p. 276).

63. EUTHALIA LUBENTINA, Cramer.

*Loranthus scurrula*, Linn. (*Loranthaceæ*).

64. VANESSA \* CARDUI, Linnæus.

*Zornia diphylla*, Pers. (*Leguminosæ*).

*Blumea* sp. (*Compositæ*).

65. CYRESTIS THYODAMAS, Boisduval.

*Ficus bengalensis*, Linn. (*Urticaceæ*).

*Ficus indica*, Linn. (*Urticaceæ*).

*Ficus glomerata*, Roxb. (*Urticaceæ*).

66. KALLIMA HORSFIELDII, Kollar.

*Strobilanthes callosus*, Nees (*Acanthaceæ*).

*Eranthemum malabaricum*, Clarke (*Acanthaceæ*).

67. DOLESCHALLIA POLIBETE, Cramer.†

*Eranthemum malabaricum*, Clarke (*Acanthaceæ*).

68. CHARAXES WARDII, Moore.

*Rourea santaloides*, W. and A. (*Connaraceæ*).

*Wagatea spicata*, Dalz. (*Leguminosæ*).

Dr. F. Moore in *Lep. Ind.*, vol. ii, p. 262, pl. clxxxviii, figs. 2, 2a, male; 2b, larva and pupa (1896), has named the South Indian form of *Charaxes schreiber*, Godart—*Eulepis wardii*. The Hon. Walter Rothschild in *Nov. Zool.*, vol. vi, p. 222 (1899), refers to it as local race a, *Eulepis schreiber wardi*. The butterfly appears as *C. schreiberi*, Godart, in the second Kanara paper, p. 257.

69. CHARAXES ATHAMAS, Drury.

*Grewia* sp. (*Tiliaceæ*).

*Cæsalpinia mimosoides*, Lam. (*Leguminosæ*).

\* *Pyrameis cardui* of previous papers. The types of both *Vanessa* and *Pyrameis* is the *Papilio atalanta* of Linnæus. *Vanessa* is the older name of the two. *Pyrameis* therefore becomes a synonym of *Vanessa*.

† In *Lep. Ind.*, vol. iv, p. 155 (1900), Dr. F. Moore has named the *Doleschallia* from N.-E. and S. India, Ceylon and Burma—*D. indica*. He restricts *D. polibete* to the Malayan Islands, Amboina, Waigiu and Batchian.

*Poinciana regia*, Bojer (*Leguminosæ*).

*Acacia pennata*, Willd. (*Leguminosæ*).

*Albizia Lebbek*, Benth. (*Leguminosæ*).

Dr. F. Moore in *Lep. Ind.*, vol. ii, p. 252 (1896) records *Eulepis athamas* from South India, while the Hon. W. Rothschild records in *Nov. Zool.*, vol. vi, p. 249 (1899) "a<sup>1</sup>. *Eulepis athamas agrarius* f. (temp. ?) *madeus*, Rothschild" from "Karwar, September and October; N. Canara, September."

70. CHARAXES FABIUS, Fabricius.

*Wagatea spicata*, Dalz. (*Leguminosæ*).

*Tamarindus indica*, Linn. (*Leguminosæ*).

71. CHARAXES IMNA, Butler.

*Saccopetalum tomentosum*, Hook. f. and T. (*Anonaceæ*).

*Aglaiia Roxburghiana*, Miq. (*Meliaceæ*).

#### Family LEMONIIDÆ.

##### Subfamily LIBYTHEINÆ.

72. LIBYTHEA RAMA, Moore.

*Celtis tetrandra*, Roxb. (*Urticaceæ*).

LARVA. At first sight the larva reminds one rather of the larva of a species of *Catopsilia* (*Pierinæ*). It is the same thickness from segment 4 to segment 10, narrowing to the head and to segment 14; segment 2 is about the same breadth as the head at the front margin, but is wider behind, and has the front margin very slightly produced in the dorsal line; the anal flap is rounded behind, and its dorsal slope is nearly a quarter of a circle, the extremity nearly touching the resting surface; it has a depressed dorsal oval mark two-thirds the width of the segment reaching from its hinder extremity towards the front margin, which surface or mark is covered with brown streaks and has no hairs on it, as has the rest of the segment; the prolegs are rather long. The head is small, being only about half as broad as the larva is at the centre; it has a dull smooth surface set with minute rather sparse dark bristles; a rather large clypeus; it is round in shape, with a shallow broad curved depression on the vertex; is green in colour with brown markings as seen under a lens, antennæ reddish, labrum green, eyes black, and some light hairs about the jaws. The surface of the body is dull, each segment has four broad ridges, that is, each segment is divided into four by thin depressed transverse lines, and on these ridges are rows of minute bristle-like black hairs all over, some even on the ventrum. The spiracles are light yellow, black-rimmed, oval, and flush to the surface, of ordinary



size. Colour dark green, sometimes with a brownish tinge, with a thin, dorsal, light yellow line from segments 4 to 12, and a narrow, yellow, supra-spiracular band from the head to the anal end. Length 26 mm., breadth at middle 4.5 mm., breadth at head 2.25 mm.

PUPA. Unlike that of any butterfly from the Kanara district, though it somewhat resembles that of *Ergolis*, but is fixed with its longitudinal axis parallel to the surface to which it is attached like that of *Elymnias caudata*, Butler; the ventral line is therefore straight from the head to segment 10, and thence the rest of the pupa is at right-angles to its longitudinal axis; the front of the pupa seen from above is absolutely square, the head ending in a broad straight edge; the head and segment 2 form a trapezoidal piece, which is broadest transversely to the pupa-length; the sides or lateral outline of this trapeze being absolutely straight lines; the dorsal line of the pupa in segments 1 and 2 is slightly convex; the thorax forms at the shoulders the broadest part of the pupa, sloping out suddenly laterally at an angle of  $135^{\circ}$  with the lateral line of the head-piece; the thorax is somewhat convex and highly carinated along the dorsal line, this carination starting from the front margin in—seen laterally—an absolute straight line to just before the hinder margin, where it ends abruptly in a somewhat rounded peak; the dorsal outline falling thus abruptly from the peak to the hinder margin of the thorax; the dorsal outline of the abdomen starts from segment  $3/4$  and ascends to a small sharp peak at the margin of segment  $5/6$ , whence it descends gradually in a very slight carination to segment  $8/9$ , and then in a curve of a quarter circle to the cremaster; a thin linear low carination connects the point of the shoulder with the abdominal peak, and the wings are slightly thickened at and behind the shoulders; the transverse section of the abdomen after the peak is nearly circular; the abdominal peak is somewhat higher than the apex of the thoracic carination, and the straight top of the thoracic carination is at an angle of  $45^{\circ}$  to the longitudinal axis of the pupa. The spiracles of segment 2 are depressed narrow slits, the other spiracles are light, nearly white, ovals facing somewhat forwards. The cremaster is dorsally triangular, and embraces somewhat the last segment, its attachment-surface being considerably longer in the sense of the length of the pupa than its breadth. Colour of pupa light green, with the tops of all the carinations yellow, with a black speck on the abdominal peak; the surface of the pupa is smooth and somewhat shiny. Length 12.5 mm., breadth at the shoulders 5 mm., breadth at the front of the head just over 3 mm., height at the abdominal peak 6 mm., height at the apex of the thorax 5 mm.

HABITS. The eggs are laid on the young shoots and leaves, generally

on a low shrub near a nulla with water in it and open to the sunlight. The larvæ live generally on the underside of the leaves, eating all but the ribs or veins to which one finds them hanging. They emit much web and fall by a silk thread when disturbed, but only when touched or otherwise violently molested; the larva rests with its true legs off the surface, and its head curved down and often turned to one side. The pupa is formed always on the underside of a leaf, and rests quite parallel to the surface of the leaf. The larva reminds one forcibly of a pierine larvæ of the *Catopsilia*, *Ixias* or *Teracolus* type. The butterfly, which is rare in the Kanara district, appears to be found only in the neighbourhood of its food-plant.

#### Subfamily NEMEOBIINÆ.

##### 73. ABISARA FRATERNA, Moore.

*Embelia robusta*, Roxb. (*Myrsinæ*).

*Ardisia humilis*, Vahl (*Myrsinæ*).

#### Family LYCÆNIDÆ.

##### 74. NEOPITHECOPS ZALMORA, Butler.

*Glycosmis pentaphylla*, Correa (*Rutaceæ*).

##### 75. SPALGIS EPIUS, Westwood.

The larva is wholly carnivorous, feeding on *Coccidæ*, and not touching vegetable food at all.

##### 76. MEGISBA MALAYA, Horsfield.

This species has never been bred.

##### 77. PLEBEIUS\* TROCHILUS, Freyer.

*Zornia diphylla*, Pers. (*Leguminosæ*).

*Heliotropium strigonum*, Willd. (*Boraginæ*).

LARVA. Of the ordinary lycænid shape, but rather narrowed at both ends, broadest a little before the middle, somewhat narrow. Head small, hidden under segment 2 in repose, having a rather long neck; nearly black with a whitish labrum; shiny, glabrous, and round. Segment 2 swollen on the front margin, somewhat depressed in the

\* Dr. A. G. Butler in *Ann. and Mag. of Nat. Hist.*, seventh series, vol. v, p. 61, n. 23 (1900), records *Plebeius trochilus*, Freyer, from Nyasaland, noting that "According to de Nicéville this is a *Chilades*." In this I followed Dr. F. Moore, who placed the *Lycæna putii* of Kollar, which is a synonym of *Lycæna trochilus*, Freyer, in the genus *Chilades*. I do not know what the type of *Plebeius* is.

centre of the dorsum, in shape a perfect semicircle. Anal end rounded, the posterior segments sloping and flattened dorsally; the usual gland, and protrusible organs on segment 12, present. Spiracles very minute, round, edged with dark colour, above the marginal red band. The surface of the body covered moderately densely with small, cylindrical, white tubercles, from the top of each of which springs a rather short, brownish hair. The colour of the body is green, with a dorsal red band edged with white, and a marginal (subspiracular) similar band edged broadly below with white; two parallel diagonal white lines on each segment, laterally, between the dorsal and marginal red bands; on the dorsal red band near the front margin of each segment 3 to 10 is a small, green spot, which, on segments 3 to 5 at least, is a distinct depression, circular in shape. Length 7 mm., breadth nearly 2.5 mm.

**PUPA.** The pupa is distinctly lycænid in shape, but is rather long and narrow, is slightly constricted dorsally behind the thorax, though not laterally; the thorax is somewhat humped; the front of the pupa is blunt, squarish; the hinder end narrow and rounded; thickest about segment 8 and highest about segment 7. The spiracles of segment 2 are indicated by an oval, white mark. The other spiracles are small, nearly round, white. The surface of the body is rather shiny, covered with small, cylindrical, white tubercles which are each surmounted by a rather long, somewhat curved, hair, these hairs are longest on the front portion of the pupa, and are nearly colourless. The colour of the pupa is green, very watery-coloured on the wings and anterior parts. Length 6 mm., breadth 2.75 mm.

**HABITS.** The egg is laid in the axil of a leaf, on the flower, or on a pod, and the larva, on emerging, gets inside the flower or pod as the case may be and feeds therein, changing the flowers, pods, &c., as necessary. It changes to a pupa on a leaf or in some such place, and the pupa has a lax tail-attachment and a body-band.

78. *CHILADES LAIUS*, Cramer.

*Citrus medica*, Linn. (*Rutacæ*).

Now recorded for the first time from Anshi and Gairsoppa in the Kanara District.

79. *CYANIRIS PUSPA*, Horsfield.

*Cylista scariosa*, Ait. (*Leguminosæ*).

*Xylia dolabriformis*, Benth. (*Leguminosæ*).

80. *CYANIRIS LIMBATUS*, Moore.

Has not been bred.

81. *ZIZERA* LYSIMON, Hübner.*Zornia diphylla*, Pers. (*Leguminosæ*)82. *ZIZERA* GAIKA, Trimen.*Nelsonia campestris*, Br. (*Acanthaceæ*).83. *ZIZERA* OTIS, Fabricius.*Zornia diphylla*, Pers. (*Leguminosæ*).

LARVA. The larva is of the ordinary limaciform shape like those of the genera *Cyaniris*, *Jamides* and *Polyommatus*. Segment 2 is semi-circular with a dorsal triangular depression as usual; the anal end is dorsally flattish, with the dorsal line inclined to the axis of the length of the larva at an angle of about  $30^\circ$ , and semicircularly rounded in outline, with the two cylindrical, protrusible organs and a slit-shaped gland; the body is broadest from segment 5 to segment 7, and highest at segment 5; segment 3 overhangs segment 2 as usual. The head is round, shiny, smooth, yellow, the jaws dark brown, the labrum white. Before the last moult the head is entirely dark shiny red-brown coloured and hidden under segment 2. The surface of the body is dull, covered with minute white tubercles each surmounted by a minute, sharp, white spine or hair; there is a subdorsal row of three or four curved, shiny, dark brown, rather large (for the size of the larva) hairs on segments 3 to 10, only two hairs on each side on segments 7 to 10; the margin of the body is rather densely hairy, especially on segments 2 and 14. Spiracles shiny, minute, round (or rather hemispherical), yellow. Colour grass green, with a subspiracular yellow band from segments 5 to 12; an indistinct dark dorsal line. Length 9 mm., breadth 3 mm.

PUPA. The pupa is of the ordinary shape of those of the genera *Cyaniris*, *Jamides* and *Polyommatus*, broadest at the middle, highest at the thorax, constricted in the dorsal line behind the thorax, rounded narrowly behind, narrowly square in front, the vertex of the head is in a plane perpendicular to the longitudinal axis of the pupa and rather large; segment 2 is straight on the front margin, with a slight triangular shallow and wide indentation in the dorsal line, and a hind margin curved concavely towards the front of the pupa: its dorsal line is in a plane at an angle of nearly  $45^\circ$  to the length of the axis, and the segment is very slightly convex transversely to the length of the pupa; the thorax is humped, and the line joining the front and hind margins is in a plane at an angle of about  $30^\circ$  to the longitudinal axis; the dorsal line of segments 4 to 14 is convex; the ventral line of the pupa is straight; the wings are slightly expanded laterally in parallel

lines. The surface of the body is smooth, slightly shiny, and covered with erect, stiff, minute, light hairs, especially along the front margin of segment 2 and about the anal end; these hairs are simple and pointed. The spiracles of segment 2 are indicated by smooth, oval, yellow surfaces, the other spiracles are minute, shiny, convex, white surfaces. The colour of the pupa is light green with a black, dorsal stripe to segment 2; a dark, dorsal, thoracic line, a black smudge along the border of the wing at segments 4 and 5, two supra-spiracular spots on segments 7 to 12, and a dorsal, dark green line on the abdominal segments; the wings and shoulders are slightly blotched with brownish. Length 7 mm., breadth 3 mm.

**HABITS.** The eggs are laid anywhere on the plant, on the leaves, stalks or flowers; the larva eats the flowers, pods, &c., and is difficult to find. The pupa, attached by the tail and by a body-band, is formed anywhere convenient, on the upperside or uunderside of any leaf, either dead or alive.

84. *LYCÆNESTHES EMOLUS*, Godart.

*Wagatea spicata*, Dalz. (*Leguminosæ*).

*Saraca indica*, Linn. (*Leguminosæ*).

*Terminalia paniculata*, Roth (*Combretaceæ*).

*Combretum extensum*, Roxb. (*Combretaceæ*).

85. *LYCÆNESTHES LYCÆNINA*, Felder.

*Buchanania latifolia*, Roxb. (*Anacardiaceæ*).

*Wagatea spicata*, Dalz. (*Leguminosæ*).

**LARVA.** The larva is of the usual onisciform shape, is rather broad and stout; the segments, being somewhat swollen dorsally, are very distinctly marked, so that the lateral view of the dorsal line shows considerable constrictions between the segments; the larva is broadest and highest at segment 7, segment 2 has the usual dorsal large depression and is semicircular, hiding the head as usual; the anal segment is thickened round the margin, and slopes dorsally at about an angle of 45° to the longitudinal axis, and is semicircular in the hinder outline; the gland, which is transverse and mouth-shaped, and the usual circular-mouthed, white, protrusible organs on segment 12, are present. Head small, shiny, smooth, yellowish; the eyes black. Spiracles of the ordinary size, round, white. Surface of the body dull, covered with small, simple, reddish hairs, which are not very densely disposed, and are for the most part nearly adpressed to the surface. The colour is dark green, with a deep rose-coloured, rather fine, but very distinct, dorsal line, and a large, triangular, greenish-yellow, subdorsal patch touching the dorsal

line in one basal angle (the base of the triangle being the hinder margin of the segment) on each segment 3 to 10, each triangle being bounded narrowly with deep rose colour exteriorly (towards the spiracles); there is a marginal (underneath the spiracles on the margin of the larva) yellow band, interrupted at the margins of the segments by a deep rose-coloured mark, along segments 4 to 10. The dorsal line extends from segment 3 to the anal end. There is a small round depression on the dorsum of segments 3, 4 and 5, also one on the front margin of segment 2, and a lateral longitudinal depression parallel to the margins of the segments on segments 3 to 6. There is a fringe of porrect hairs round the margin of segment 2. Length 11 mm., breadth 5 mm.

**PUPA.** The pupa is nearly exactly like that of *Lycænesthes emolus*, Godart, except that it is slightly more robust, *i.e.*, stouter and more compact. The diamond-shaped dorsal mark at the hinder margin of the thorax is also present, it is this marking indeed that makes the pupa so similar to that of *L. emolus*. The pupa is blunt in front, the vertex of the head is flat, and in a plane at right-angles to the longitudinal axis of the pupa; the head is not visible from above; segment 2 is more or less semicircular in outline as to the front margin, though somewhat squarish to fit the flat head-surface; no dorsal constrictions, except that segment 4 is slightly lower than the apex of the thorax; no lateral constriction; the thoracic dorsal slope is gradual and in the same line with that of segment 2, which is at an angle of less than 45° with the longitudinal axis of the pupa; the apex of the thorax, which is just near its hinder margin, is the highest point of the pupa, and the broadest part is at segment 7, though the breadth varies little from the shoulders to that segment; the anal end of the pupa is somewhat broadly rounded. The spiracles of segment 2 are indicated by narrow white slits; the other spiracles are raised, oval and white. The surface of the body is covered with very minute, white tubercles which are not very densely disposed. The colour is green with a dorsal thoracic yellow line, the thoracic dorsal diamond being yellow margined with brown; there is a lateral interrupted yellowish line; the ventrum and underside are whitish; the margins of segments 1/2 and 2/3 and the wings show whitish-yellow; and the whole pupa is more or less spotted-looking. Length 10 mm., breadth at centre 4.5 mm., height at thoracic apex 4 mm.

**HABITS.** The egg is laid on a flower or in an axil of a flower stalk, and the caterpillar at first bores into a flower bud, but afterwards lives outside curled round the flowers generally on which it feeds, being very difficult to see owing to its patchy coloration. It pupates amongst the flowers, or on a flower stem, or on a leaf, &c., fixing itself by a body-band and by the tail.

86. TALICADA NYSEUS, Guérin.  
*Bryophyllum calycinum*, Salisb. (*Crassulaceæ*).

87. EVERES ARGIADES, Pallas.  
*Cylista scariosa*, Ait. (*Leguminosæ*).

88. NACADUBA MACROPHALMA, Felder.  
Has never been bred.

89. NACADUBA HERMUS, Felder.  
Has never been bred.

90. NACADUBA NOREIA, Felder.  
*Acacia Intsia*, Willd. (*Leguminosæ*).  
*Acacia Intsia*, var. *cæsia*, W. and A. (*Leguminosæ*).  
*Acacia pennata*, Willd. (*Leguminosæ*).

91. NACADUBA ATRATA, Horsfield.  
*Wagatea spicata*, Dalz. (*Leguminosæ*), *N. plumbeomicans*.  
*Embelia robusta*, Roxb. (*Myrsinæ*), *N. atrata*.  
*Ardisia humilis*, Vahl (*Myrsinæ*), *N. atrata*.

Under this name I have included *N. plumbeomicans*, Wood-Mason and de Nicéville, a species originally described from the Andamans, as it is doubtfully distinct from *N. atrata*, Horsfield, although in the second Kanara paper separate descriptions are given of the larva and pupa of both. Mr. Bell thinks that the two butterflies may be distinct.

92. NACADUBA DANA, de Nicéville.  
This species has never been bred.

93. JAMIDES BOCHUS, Cramer.  
*Butea frondosa*, Roxb. (*Leguminosæ*).  
*Pongamia glabra*, Vent. (*Leguminosæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).

94. LAMPIDES ELPIS, Godart.  
*Kæmpferia pandurata*, Roxb. (*Scitaminæ*).  
*Hedychium coronarium*, Kœnig (*Scitaminæ*).  
*Amomum microstephanum*, Baker (*Scitaminæ*).  
*Eleltaria Cardamomum*, Matou (*Scitaminæ*), the cultivated cardamom.

95. LAMPIDES CELENO, Cramer.  
*Abrus precatorius*, Linn. (*Leguminosæ*).

*Pongamia glabra*, Vent. (*Leguminosæ*).  
*Saraca indica*, Linn. (*Leguminosæ*).

96. CATOCHRYSOPS STRABO, Fabricius.  
*Schleichera trijuga*, Willd. (*Sapindaceæ*).  
*Ougeinia dalbergioides*, Benth. (*Leguminosæ*).  
*Cylista scariosa*, Ait. (*Leguminosæ*).

97. EUCHRYSOPS CNEJUS, Fabricius.  
*Ougeinia dalbergioides*, Benth. (*Leguminosæ*).  
*Cylista scariosa*, Ait. (*Leguminosæ*).

In "The Entomologist," vol. xxxiii, p. 1 (1900), Dr. A. G. Butler describes the genus *Euchrysops*, which differs from the genus *Catochrysops*, Boisduval (which has hairy eyes), by having the eyes of the imago "Quite smooth instead of hairy."

98. EUCHRYSOPS PANDAVA, Horsfield.  
*Wagatea spicata*, Dalz. (*Leguminosæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).

99. TARUCUS THEOPHRASTUS, Fabricius.  
*Zizyphus Jujuba*, Lamk. (*Rhamnææ*).

100. TARUCUS TELICANUS, Lang.  
*Ougeinia dalbergioides*, Benth. (*Leguminosæ*).

This is an older name for *Tarucus plinius*, Fabricius, of the Kanara lists. In the first Kanara list, p. 353, it is noted that the larva in Bombay feeds on *Sesbania aculeata*, Pers. (*Leguminosæ*).

101. CASTALIUS ROSIMON, Fabricius.  
*Zizyphus Jujuba*, Lamk. (*Rhamnææ*).

102. CASTALIUS ANANDA, de Nicéville.  
*Zizyphus Jujuba*, Lamk. (*Rhamnææ*).  
*Zizyphus Xylopyrus*, Willd. (*Rhamnææ*).  
*Zizyphus rugosa*, Lamk. (*Rhamnææ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).  
*Loranthus longiflorus*, Desrouss. (*Loranthaceæ*).

103. CASTALIUS ETHION, Doubleday and Hewitson.  
*Zizyphus Jujuba*, Lamk. (*Rhamnææ*).  
*Zizyphus Xylopyrus*, Willd. (*Rhamnææ*).



104. *CASTALIUS DECIDIA*, Hewitson.  
*Zizyphus rugosa*, Lamk. (*Rhamnaceæ*).

105. *POLYOMMATUS BÆTICUS*, Linnæus.  
*Butea frondosa*, Roxb. (*Leguminosæ*).  
*Cajanus indicus*, Spreng. (*Leguminosæ*).

106. *AMBLYPODIA ANITA*, Hewitson.  
*Olax scandens*, Roxb. (*Olacineæ*).

107. *IRAOTA TIMOLEON*, Stoll.  
*Ficus bengalensis*, Linn. (*Urticaceæ*).  
*Ficus indica*, Linn. (*Urticaceæ*).  
*Ficus glomerata*, Roxb. (*Urticaceæ*).

108. *SURENDRA QUERCETORUM*, Moore.  
*Acacia Intsia*, Willd. (*Leguminosæ*).  
*Acacia pennata*, Willd. (*Leguminosæ*).

109. *THADUKA MULTICAUDATA*, Moore.  
*Trewia nudiflora*, Linn. (*Euphorbiaceæ*).

EGG. The egg is similar in shape to that of the species of the genus *Arrhopala*, *i.e.*, it is dome-shaped, but is broadest above the base; it looks, however, to be turban-shaped, *i.e.*, flat on the top. The reason of this is that there are two rows of long delicate feathery-looking spikes, finely bifurcated at the top, placed at right-angles to the polar axis of the egg and slightly converging, one row to the other, at the points. There are two-and-a-half cells from the base to near the summit of the egg, and these spikes are situated where the walls of the middle row of cells intersect with the walls of the top perfect cells and the bottom demi-cells. The cells are large, nearly regularly quadrilateral, with fine rather high walls, and are flat-bottomed. On the summit the egg is punctuated, and has a rather large, central, circular depression (micropyle). The colour is finely granulated green, the walls of the cells and the spikes being white. The cells round the "equator" of the egg are ten in number. The breadth of the egg is 0.6 mm., and the height 0.4 mm.

LARVA. The larva in shape and habits agrees in all respects absolutely with that of the species of the genus *Arrhopala*. The head is hidden beneath the second segment, is shiny, rather large, and black. Segment 2 is semi-circular, very slightly indented in the middle of the front margin; the middle dorsal depression is semi-elliptical (round end

anterior), velvety black, with a dorsal green line. Segment 3 is suddenly somewhat higher and broader than segment 2. Segments 4 to 11 nearly of the same breadth and length; segments 12 to 14 decrease in breadth, the anal segment being rather flat, thickened round the outer margin, and broadly rounded at the end, with a dorsal square velvety black patch bisected by a dorsal green line. The whole larva is depressed, being of one height from segment 4 to segment 10, both inclusive. The spiracles are plainly visible, rather long ovals in shape, and yellow in colour. The surface of the body is covered with minute, short, star-like hairs, light-coloured and sparse; on the black patches they are black and denser than anywhere else; the surface is also laterally corrugated on each segment, with a few latero-ventral deep punctuations; the whole margin of the larva bears long simple hairs placed somewhat far apart. The gland on segment 11 is large and conspicuous, surrounded by an oval, deep black patch, which patch has a thin green line all round just within its margin; the longer axis of the oval is transverse to the body length. The organs on segment 12 are circular-mouthed, protruded as white cylinders. The colour of the larva is light green, with a dorsal dark green line flanked on either side by a white line; a latero-dorsal white line; a lateral white line: all six white lines commence on segment 3, and end just in front of the gland on segment 11. The segments are distinct. The space on the dorsum between the lateral white line and the white line flanking the dorsal green line is obscure rose-coloured. The larva changes to a brown-pink before turning into a pupa. The total length of the full-grown larva is 19 mm., the breadth is 7.5 mm.

PUPA. The pupa resembles that of the species of the genus *Arrhopala*. The head is hidden, bowed. Segment 2 is large, very convex, with a semi-circular front margin, ascending in the dorsal line at the same angle as the front of the thorax. Thorax very evenly curved to the apex, then evenly descending to segment 5 from the rounded apex. The pupa is slightly constricted dorsally behind the thorax, not at all laterally; dorsal outline straight from segments 5 to 8, then descending gradually to the front margin of segment 10, after which the surface is perpendicular to the longitudinal axis of the pupa. In lateral outline the pupa increases from the head to the slightly angular shoulders, then still more, though slightly, to segments 7 and 8, after which it decreases gradually to the end; the end is rounded, though not broadened out like a hoof, and is applied round the margin closely to the surface of suspension. The shoulder has a small tubercular swelling. The spiracular expansion of segment 2 is small, long, facing forwards. Spiracles with swollen lips, oval, conspicuous, light brown in colour. Gland scar and marks of organs of segment 12

conspicuous. Body surface very finely covered with minute tubercular granules which sometimes coalesce into lines. Colour very dark rosy-brown, lighter on the abdomen and dorsum; a dorsal light brown line on segments 2 to 4; a row of two or three light brown spots parallel to the margins of the segments on each side of the dorsal line on segments 6 to 10. Underparts of pupa light rosy-brownish-yellow. The pupa is fastened by the tail and a median band. Total length 14 mm., breadth at segment 7 is 6.5 mm., height at the apex of the thorax 5.3 mm., breadth at the shoulders 5 mm.

**HABITS.** The eggs are laid singly or in twos and threes on leaves, leaf stalks, stems and twigs, even on the trunk of the tree, generally in cracks, crevices, or axils. One female lays many on the same tree. The butterfly is fond of the sun, and sits for long periods on one leaf basking with closed wings, sometimes on a twig, stem, or trunk of a tree; with care it can be caught in the fingers, but once on the wing its flight is extremely rapid though not sustained. The larva from the first moult makes a house or shelter for itself by turning over a bit of the edge of a leaf, fixing it and lining it with silk, and eating holes all round through both the layers of the leaf except on the outer side; it makes new nests as required, feeding always on the tender leaf on which is its house. It wanders off to some crevice in the bark, hole in the tree, or even down to the ground, to pupate, getting under a dead leaf, or clod of earth, or into a hole in the ground, in the latter case. A dozen pupæ are sometimes found together. The butterfly is difficult to kill by squeezing. Some of the larvæ are attended by ants of the genus *Cre mastogaster*, some are not: at any rate the ants do not appear to care much for them, as they will leave them on the slightest alarm. The pupæ are sometimes attended by these same ants. The reason the butterfly is so rare is most probably because the tree on which the larva feeds is, as a general rule, about 150 feet in height, with a clear stem of some 60 feet, and the butterflies keep to the top. The reason of the success in obtaining so many larvæ and pupæ was that extensive cuttings of this tree had taken place, and there were large areas covered with young stool-shoots. Generally, at other times, and in other places the butterflies—or what was presumed to be this butterfly—have been noticed flying round and basking on the leaves of the tops of high trees of *Trewia nudiflora*, Linn. The known range of this butterfly is curious, as it is recorded only from Tenasserim in Burma and from the Nilgiri Hills and North Kanara in South-Western India. The female has hitherto only been recognised: Mr. Bell has sexed when freshly caught and newly emerged all the specimens (a large number) in his collection. The male can hardly be said to differ superficially from the female, it is usually somewhat

smaller, and the bright smalt-blue of both wings on the upperside is slightly lighter and more silvery in shade.

110. *ARRHOPALA CENTAURUS*, Fabricius.  
*Hopea Wightiana*, Wall. (*Dipterocarpeæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).  
*Terminalia tomentosa*, Bedd. (*Combretaceæ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).  
*Lagerstræmia lanceolata*, Wall.\* (*Lythraceæ*).

111. *ARRHOPALA AMANTES*, Hewitson.  
*Hopea Wightiana*, Wall. (*Dipterocarpeæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).  
*Lagerstræmia lanceolata*, Wall. (*Lythraceæ*).

112. *ARRHOPALA ABSEUS*, Hewitson.  
 Has not been bred in Kanara.

113. *ARRHOPALA CANARAICA*, Moore.  
*Hopea Wightiana*, Wall. (*Dipterocarpeæ*).

114. *ARRHOPALA BAZALUS*, Hewitson.  
*Hopea Wightiana*, Wall. (*Dipterocarpeæ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).

115. *CURETIS THETIS*, Drury.  
*Abrus precatorius*, Linn. (*Leguminosæ*).  
*Pongamia glabra*, Vent. (*Leguminosæ*).  
*Derris Heyneana*, Benth. (*Leguminosæ*).  
*Wagatea spicata*, Dalz. (*Leguminosæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).

Mr. Bell notes that the larva of this species feeds on other species of *Leguminosæ* than those named above.

116. *CURETIS BULIS*, Doubleday and Hewitson.  
*Ougeinia dalbergioides*, Benth. (*Leguminosæ*).

117. *ZESIUS CHRYSOMALLUS*, Hübner.  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).

\* This plant in the second Kanara paper, p. 382, appears under the name of *Lagerstræmia microcarpa*, Wight, which is given by Sir J. D. Hooker as a synonym of *L. lanceolata*.

- Terminalia tomentosa*, Bedd. (*Combretaceæ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).  
*Psidium Guyava*, Linn. (*Myrtaceæ*).  
*Clerodendron infortunatum*, Gaertn. (*Verbenaceæ*).  
*Argyreia speciosa*, Sweet (*Convolvulaceæ*).  
*Loranthus longiflorus*, Desrouss. (*Loranthaceæ*).

Mr. Bell notes that the larva of this butterfly is found on many other plants than those given above frequented by the ferocious red, or yellow, tree ant, *Ecophylla smaragdina*, Fabricius. The larvæ are so persistently carnivorous that each one has to be bred by itself.

118. CAMENA ARGENTEA, Aurivillius.

*Camena* (1865) is perhaps too near to *Camæna* (1850), the latter name having priority, in which case the former name must give way to *Pratapa*. This butterfly appears in the second Kanara paper, p. 384, as *Camena cippus*, Fabricius, but Dr. Chr. Aurivillius in Ent. Tids., vol. xviii, p. 146, n. 48 (1897), has shown that the true "*Hesperia*" *cippus* of Fabricius is the same as "*Hesperia*" (*Tajuria*) *longinus*, Fabricius, and that the latter name must sink as a synonym to the former, which is the older. Dr. Aurivillius has renamed the *Camena cippus* of authors, but not of Fabricius, *Pratapa argentea*. It has never been bred.

119. CAMENA DEVA, Moore.

- Loranthus scurrula*, Linn. (*Loranthaceæ*).  
*Loranthus tomentosus*, Heyne (*Loranthaceæ*).

120. CREON CLEOBIS, Godart.

- Loranthus scurrula*, Linn. (*Loranthaceæ*).  
*Loranthus elasticus*, Desrouss. (*Loranthaceæ*).

121. APHNEUS VULCANUS, Fabricius.

- Zizyphus Jujuba*, Lamk. (*Rhamnaceæ*).  
*Zizyphus rugosa*, Lamk. (*Rhamnaceæ*).

122. APHNEUS LOHITA, Horsfield.

- Zizyphus rugosa*, Lamk. (*Rhamnaceæ*).  
*Wagatea spicata*, Dalz. (*Leguminosæ*).  
*Xylia dolabrifformis*, Benth. (*Leguminosæ*).  
*Terminalia paniculata*, Roth (*Combretaceæ*).  
*Psidium Guyava*, Linn. (*Myrtaceæ*).  
*Lagerstræmia lanceolata*, Wall. (*Lythraceæ*).  
*Argyreia sericea*, Dalz. and Gibs. (*Convolvulaceæ*).  
*Dioscorea pentaphylla*, Linn. (*Dioscoreaceæ*).

Under *A. lohita* the *A. concanus* of Moore, which is recorded (p. 386) doubtfully as a species distinct from *A. lohita* in the second Kanara paper, is included.

123. *APHNÆUS ABNORMIS*, Moore.

A single specimen has been obtained in the Kanara district at Jaggalbett, above the ghâts. It has never been bred.

124. *APHNÆUS ICTIS*, Hewitson.

There is a single male of this species in Mr. Bell's collection which I have examined. It has never been bred. This species and the last are new to the Kanara list.

125. *TAJURIA INDRA*, Moore.

*Loranthus elasticus*, Desrouss. (*Loranthaceæ*).

126. *TAJURIA CIPPUS*, Fabricius.

*Loranthus Wallichianus*, Schultz. (*Loranthaceæ*).

*Loranthus scurrula*, Linn. (*Loranthaceæ*).

*Loranthus longiflorus*, Desrouss. (*Loranthaceæ*).

*Loranthus elasticus*, Desrouss. (*Loranthaceæ*).

This species appears in the second Kanara paper as *Tajuria longinus*, Fabricius. With regard to the change of name see No. 118 *ante*.

127. *TAJURIA JEHANA*, Moore.

Mr. Bell has a male of this species taken at Karwar in the North Kanara district. It is new to the list of Kanarese butterflies, and has never been bred.

128. *OPS MELASTIGMA*, de Nicéville.

*Loranthus scurrula*, Linn. (*Loranthaceæ*).

*Loranthus tomentosus*, Heyne (*Loranthaceæ*).

129. *CHLIARIA OTHONA*, Hewitson.

*Rhynchostylis retusa*, Blume (*Orchidææ*).

*Saccolabium papillosum*, Lindl. (*Orchidææ*).

130. *ZELTUS ETOLUS*, Fabricius.

This species has never been bred.

131. *CHERITRA JAFFRA*, Butler.

*Saraca indica*, Linn. (*Leguminosææ*).

*Xylia dolabriformis*, Benth. (*Leguminosæ*).  
*Cinnamomum zeylanicum*, Breyne (*Laurinæ*).

132. RATHINDA AMOR, Fabricius.  
*Hopea Wightiana*, Wall. (*Dipterocarpeæ*).  
*Schleichera trijuga*, Willd. (*Supindacææ*).  
*Eugenia zeylanica*, Wight (*Myrtacææ*).  
*Careya arborea*, Roxb. (*Myrtacææ*).  
*Ixora coccinea*, Linn. (*Rubiaceæ*).  
*Loranthus longiflorus*, Desrouss. (*Loranthacææ*).  
*Croton* sp. (*Euphorbiacææ*).

133. HORAGA ONYX, Moore.  
 This species has never been bred.

134. CATAPÆCILMA ELEGANS, Druce.  
*Terminalia tomentosa*, Bedd. (*Combretacææ*).  
*Terminalia paniculata*, Roth (*Combretacææ*).  
*Lagerstræmia lanceolata*, Wall. (*Lythraceææ*).  
 Mr. H. H. Druce in Proc. Zool. Soc. Lond., 1895, p. 612, suggests that if the Sumatran, Indian and Ceylonese species of *Catapæcilma* allied to *C. elegans* should prove to be distinct from the typical Bornean form it may be called *C. major*.

135. LOXURA ATYMNUS, Cramer.  
*Dioscorea pentaphylla*, Linn. (*Dioscoreacææ*).  
*Smilax macrophylla*, Roxb. (*Liliacææ*).  
 The pupa of this species is suspended by the tail only, with no median band. In the second Kanara paper, p. 390, the latter is inadvertently given as being present.

As the eight genera, *Camena*, *Creon*, *Aphnæus*, *Tajuria*, *Ops*, *Cheritra*, *Rathinda* and *Loxura* have the pupa suspended by the cremaster only with no median girth, they would seem to form one very natural group, this character being an extremely aberrant one in the *Lycænidææ*. The larvæ and pupæ in these genera are also very similar. In the genus *Spalgis* also the pupa is attached by the cremaster only with no median band.

136. DRUDORIX EPIJARBAS, Moore.  
*Connarus Ritchiei*, Hook. f. (*Connaracææ*).

137. ZINAPSA TODARA, Moore.  
*Acacia Intsia*, Willd. (*Leguminosææ*).

*Acacia Intsia*, var. *cæsia*, W. and A. (*Leguminosæ*).  
*Acacia pennata*, Willd. (*Leguminosæ*).

138. RAPALA SCHISTACEA, Moore.

*Acacia Intsia*, var. *cæsia*, W. and A. (*Leguminosæ*).  
*Acacia pennata*, Willd. (*Leguminosæ*).  
*Quisqualis indica*, Linn. (*Combretacæe*).

139. RAPALA LANKANA, Moore.

*Wagatea spicata*, Dalz. (*Leguminosæ*).  
*Acacia Intsia*, var. *cæsia*, W. and A. (*Leguminosæ*).  
*Acacia pennata*, Willd. (*Leguminosæ*).

LARVA. The larva is similar in shape to the larvæ of other species of *Rapala*. Head shiny, smooth, very light yellow, with the jaws and the basal joint of the antennæ white. The "teeth" or processes on the segments are round-topped, with a slight constriction before the end of each tooth, giving the teeth the appearance of being ball-topped; the anal teeth and subdorsal teeth of segment 2 are smaller than the rest, being little more than knobs. There is a subdorsal tooth to each segment except segment 13, a subspiracular tooth to each segment except segments 13 and 14; the subdorsal teeth of segments 11 and 12 are much further apart than on any other segment; the teeth of segment 2 are on the front margin, those of segment 14 on the hinder margin, all the rest in the middle of their respective segments. The surface of the body is smooth, oily-looking, each tooth having about eight golden-coloured hairs proceeding from the extremity, which are about the same length as the tooth itself. The spiracles are oval and black; the gland on segment 11, and the cylindrical protrusible organs of segment 12, are present. The colour of the larva is a light oily yellow-greenish, with a diagonal white band along the base of each subdorsal tooth, and below it, from the front margin near the subdorsal line down and back to the hinder margin to just behind the spiracle; the area on each segment in front of this line is suffused with brown; a light brown patch with a white cross on it dorsally on segment 2, and a small subdorsal green rising on the hinder margin of that segment; the dorsal parts of segments 11 and 12 are pink-greenish; there is a dorsal bluish line. The colour of the larva may be dark green with the diagonal lines yellow, and the areas in front of these lines deep rich brown-red when it is feeding on the red flowers of *Wagatea spicata*, Dalz. Length 19 mm. if moving, breadth 5 mm. omitting the teeth, .7 mm. if the teeth be included.

PUPA. The pupa agrees in shape with those of the other species of *Rapala* found in North Kanara, the length from segment 4/5 to the front



being about equal to the length from the same point to the anal end; the breadth is greatest at segment 7, though but little more than at the shoulders; the height is the same at segment 7 and at just before the hinder margin of the thorax; the vertex of the head is inclined towards the ventral line of the pupa; the front margin of segment 2 slightly overhangs the head, and its dorsal line is inclined at an angle of about  $45^\circ$  to the length axis of the pupa; this segment is large, rather square in the front outline (which is the front of the pupa), and slightly pinched laterally behind the spiracles on the margin of segment  $2/3$ ; the thorax is very large, and increases in breadth from the front margin to the shoulders, is slightly pinched in front dorsally, and has the hinder margin coming to a point in the dorsal line; its dorsal line is evenly curved, is at an angle of  $45^\circ$  to the length-axis of the pupa in its anterior half, and curves through a plane parallel to that axis as far as the margin of segment  $3/4$ ; segment 4 has its dorsal line inclined from the front margin to the hinder margin towards the length-axis, so that the pupa is constricted somewhat dorsally, its dorsal line rising again from segment  $4/5$  to segment 7; the margin of segment  $9/10$  is raised, as is usual with the pupæ of *Rapala*, there being a thin interval between the margins; the hinder end of the pupa is rounded; the ventral line is straight. The surface of the pupa is finely reticulated, and has some minute erect hairs on segment 2, on the thorax, and on the dorsum of the other segments; these hairs are sparse. The spiracles of segment 2 are raised, oval, small, golden-yellow surfaces which face forwards, the other spiracles are of the same colour, small, oval and raised. The colour of the pupa is light rose-brown, segments 4 and 5 are generally dark, the margin of segment  $9/10$  is dark; there is a dorsal darkish line and a darkish lateral spot on each abdominal segment; the wings, segment 2, and the sides of the thorax, are darkish. Length 12.25 mm., breadth 6.25 mm. at segment 7, at the shoulders 5.75 mm.

**HABITS.** The larva lives on the flowers and young parts of the plant on which it feeds, and always on such plants as are frequented by the large red ants *Ecophylla smaragdina*, Fabricius, which tend the larvæ. Pupation takes place anywhere, amongst the flowers, in the crevices of the stems, &c., and the pupa is attached by the tail and by a body-band. The pupa when disturbed makes the usual creaking noise which is so common amongst lycænid pupæ.

140. *RAPALA VARUNA*, Horsfield.

*Zizyphus Xylopyrus*, Willd. (*Rhamnæ*).

*Zizyphus rugosa*, Lamk. (*Rhamnæ*).

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*Xylia dolabriformis*, Benth. (*Leguminosæ*).  
*Quisqualis indica*, Linn. (*Ombretaceæ*).

141. RAPALA MELAMPUS, Cramer.  
*Zizyphus rugosa*, Lamk. (*Rhamnææ*).  
*Ougeinia dalbergioides*, Benth. (*Leguminosæ*).

142. BINDAHARA SUGRIVA, Horsfield.  
*Salacia oblonga*, Wall. (*Celastrinææ*).

143. VIRACHOLA ISOCRATES, Fabricius.  
*Tamarindus indica*, Linn. (*Leguminosæ*).  
*Punica Granatum*, Linn. (*Lythraceæ*).  
*Randia uliginosa*, DC. (*Rubiaceæ*).

144. VIRACHOLA PERSE, Hewitson.  
*Anona squamosa*, Linn. (*Anonaceæ*).  
*Randia uliginosa*, DC. (*Rubiaceæ*).  
*Randia dumetorum*, Lamk. (*Rubiaceæ*).

#### Family PAPILIONIDÆ.

##### Subfamily PIERINÆ.

145. LEPTOSIA XIPHIA, Fabricius.  
*Cratæva religiosa*, Forst. (*Capparidææ*).  
*Capparis Heyneana*, Wall. (*Capparidææ*).  
*Capparis sepiaria*, Linn. (*Capparidææ*).  
*Capparis horrida*, Linn. f. (*Capparidææ*).

This butterfly appears in the second Kanara list under the synonymic generic name *Nychitona*.

146. DELIAS EUCHARIS, Drury.  
*Loranthus longiflorus*, Desrouss. (*Loranthaceæ*).

147. PRIONERIS SITA, Felder.

This rare butterfly has not been bred in Kanara, but Mr. Bell has seen a female laying eggs on a plant which is probably *Capparis tenera*, Dalz. (*Capparidææ*). The eggs hatched out, but the larva failed to reach maturity. In Ceylon Mr. E. E. Green says that the larva feeds on *Capparis*.

148. CATOPSILIA PYRANTHE, Linnæus.  
*Cassia occidentalis*, Linn. (*Leguminosæ*).

149. CATOPSILIA CROCALE, Cramer.

*Cassia Fistula*, Linn. (*Leguminosæ*).

*Cassia siamea*, Lam.\* (*Leguminosæ*).

LARVA. The larva [of *C. catilla*, Cramer] is very similar in every way to that of *Catopsilia crocale*, Cramer [these two species are in de Nicéville's opinion one and the same species]. The head is round, green, the clypeus edged with brown, covered with small, shiny, black tubercles which are not very large and do not hide the colour of the head; the anal flap is rounded, but looks square at the extremity, and is covered with small tubercles, not black but green, each bearing a short hair; the body is covered with rows of small black tubercles as in *C. crocale*, of which only the row along the spiracular line is conspicuous. The spiracles are oval, shiny and white. The colour is green, with a spiracular white band touched with bright yellow on segments 2 to 5, and these segments, especially 3 and 4, are distinctly flanged on the spiracular line as in the larva of *Hebomoia australis*, Butler, though not to so great an extent. Length 51 mm., height 7 mm.

PUPA. The pupa is the same as that of *C. crocale* at first sight, but the dorsal line of the thorax is absolutely parallel to the longitudinal axis of the pupa for two-thirds of its length; consequently the hinder part just before the margin is perpendicular to this parallel part, *i.e.*, is raised suddenly though very slightly above the front margin of segment 4, and the front end of this parallel dorsal line is at an angle, and a sharpish angle, with the front slope of the thorax; the shoulder too is distinctly angled, *i.e.*, the point where the lateral line of the head and segment 2 meets that of the wings; the front margins of segments 9 and 10 in the dorsal line when looked at sideways show a minute peak overhanging the hinder margins of segments 8 and 9 respectively; the cremaster is distinctly bifid at the extremity, and has some shiny, very short, black suspensory hooks dorsally as well as at the extremity. There is a dorsal rugose black tip to the snout terminating the head, which snout is cylindrical in its apical half; there is no black line round the eye as in *C. crocale*, and there is a dark green-blue dorsal line, which is yellow on the thorax, as well as the supra-spiracular yellow line. Length 34 mm., length of snout 3 mm., breadth at segment 7 is 9 mm., height at apex of curve of wings (segment 6) 10 mm., height at the apex of the thorax 8 mm.

[—] HABITS. The habits are the same as in *C. crocale* in every particular both as to the larva and the pupa. Mr. Bell notes that until the day (30th July, 1898), on which he wrote this description he always

\* This plant appears in the first Kanara paper, p. 360, under its synonymic name *Cassia sumatrana*, Roxb.

considered *C. crocale* and *C. catilla* were one and the same butterfly, but it always struck him as somewhat anomalous that nearly all the butterflies caught below the hills on the North Kanara coast should be of the former form, while the great majority of those caught on the tops of the hills and in the heavy jungles should be of the latter form. There is but little doubt, he says, that the former is a more or less open-country butterfly, while the latter keeps nearly altogether to the jungles.

150. TERIAS HECABE, Linnæus.

*Sesbania aculeata*, Pers. (*Leguminosæ*).

*Cassia occidentalis*, Linn. (*Leguminosæ*).

*Cassia Tora*, Linn. (*Leguminosæ*).

*Cassia glauca*, Lam. (*Leguminosæ*).

151. TERIAS SILHETANA, Wallace.

*Poinciana regia*, Bojer (*Leguminosæ*).

*Wagatea spicata*, Dalz. (*Leguminosæ*).

152. TERIAS LIBYTHEA, Fabricius.

*Cassia pumila*, Lam. (*Leguminosæ*).

153. TERIAS LÆTA, Boisduval.

This butterfly has not been bred in Kanara.

154. TERIAS VENATA, Moore.

There are specimens of this species in Mr. Bell's and my own collection taken in Karwar in October. It is new to the Kanara list, and it has not been bred.

155. TERACOLUS AMATA, Fabricius.

*Salvadora persica*, Linn. (*Salvadoracææ*).

156. TERACOLUS ETRIDA, Boisduval.

*Gadaba indica*, Lamk. (*Capparidææ*) in Bombay.

Mr. Bell has caught a single specimen only of this butterfly in Kanara, from whence Dr. Butler also records it.

157. TERACOLUS EUCHARIS, Fabricius.

*Capparis sepiaria*, Linn. (*Capparidææ*) at Bijapur.

This species is new to the Kanara list. Dr. F. Moore has recorded it from North Kanara as *T. pallens*, Moore, which is a synonym

of *T. eucharis*. Mr. Bell has received it from Bijapur, which lies N.-E. of Kanara, but has never taken it in Kanara itself.

158. *IXIAS PYRENE*, Linnæus.

*Capparis sepiaria*, Linn. (*Capparidæ*) at Bijapur.

Dr. A. G. Butler in his latest revision\* of the genus *Ixias* restricts *I. pyrene*, Linnæus, to China, and records *I. frequens*, Butler, from "India generally," *I. dharmasalæ*, Butler, from "India, from Darjiling to the Western Provinces and southwards to the Neilgherries," and *I. pirenassa*, Wallace, from "Western India southwards to Depalpur." It is unknown to the writer to which of these species, if any, Dr. Butler would assign the butterfly that is placed here under the parent form. *I. cingalensis*, Moore, is restricted by Dr. Butler to Ceylon. Mr. Bell doubts the occurrence of *I. pyrene* in Kanara, though it certainly occurs commonly elsewhere in the Bombay Presidency, and at Bijapur, N.-E. of Kanara, but it has been recorded from "A place half-way up the ghât on the road to the Gairsoppa Falls."

159. *IXIAS MARIANNE*, Cramer.

*Capparis sepiaria*, Linn. (*Capparidæ*).

New to the Kanara list. It is common on the Malemani or Gairsoppa Ghât in Kanara. It has not been bred in Kanara.

160. *HEBOMOIA AUSTRALIS*, Butler.

*Cratæva religiosa*, Forst. (*Capparidæ*).

*Capparis Heyneana*, Wall. (*Capparidæ*).

*Capparis Moonii*, Wight (*Capparidæ*).

*Capparis sepiaria*, Linn. (*Capparidæ*).

This species appears in the second Kanara list as *H. glaucippe*, Linnæus, but Dr. Butler has recently separated off the South Indian and Ceylonese form under the name *H. australis* from the North-East Indian, Burmese, Malayan Peninsula and Chinese *H. glaucippe*.†

161. *NEPHERONIA PINGASA*, Moore.

*Capparis Heyneana*, Wall. (*Capparidæ*).

162. *NEPHERONIA HIPPIA*, Fabricius.

*Capparis Heyneana*, Wall. (*Capparidæ*).

*Capparis horrida*, Linn. f. (*Capparidæ*).

\* Ann. and Mag. of Nat. Hist., seventh series, vol. i, pp. 133-143 (1898).

† Ann. and Mag. of Nat. Hist., seventh series, vol. i, pp. 289-293 (1898).

163. *APPIAS LIBYTHEA*; Fabricius.*Cratæva religiosa*, Forst. (*Capparidææ*).*Capparis horrida*, Linn. f. (*Capparidææ*).

This species is entirely omitted from Dr. A. G. Butler's recent monograph of the genus *Catophaga* (Ann. and Mag. of Nat. Hist., seventh series, vol. ii, pp. 392-401, 458-467 (1898)). Possibly with *A. zelmira*, Cramer, he considers it to be a true *Appias*, and generically distinct from the genus *Catophaga*, Hübner.

164. *APPIAS TAPROBANA*, Moore.*Cratæva religiosa*, Forst. (*Capparidææ*).

This species is given in the second Kanara list as *A. hippoides*, Moore, that species being a synonym of *A. hippo*, Cramer, found in North India, Burma, the Malay Peninsula, Indo-China, China, and many islands of the Malay Archipelago. *A. hippo* is distinct from *A. taprobana*, the latter occurring in South India and Ceylon only.

165. *APPIAS ALBINA*, Boisduval.*Hemicyclia venusta*, Thwaites (*Euphorbiacææ*).

This species is given as *A. neombo*, Boisduval, in the second Kanara list. *A. neombo* is a species which cannot be satisfactorily identified, though I have some specimens of *Appias* from North Kanara that agree fairly well with the original description, but these in my opinion do not represent a distinct species, but are probably a dry-season form of *A. wardii*, Moore, or possibly of *A. albina*, Boisduval. They were all caught or bred in December. Dr. A. G. Butler in Ann. and Mag. of Nat. Hist., seventh series, vol. ii, p. 397, n. 11 (1898), places *Pieris neombo* as a synonym of *Catophaga albina*.

LARVA. The larva is very like that of *Appias taprobana*, Moore, in appearance, but is as a rule more thickly covered with black tubercles. The body is more or less cylindrical, but narrows somewhat at segments 2 and 3, and still less so at the anal end; the anal flap is thick, semicircularly rounded, and inclined at an angle of 45° to the length-axis of the larva, and has a small, very slightly developed, conical tubercle before the extremity on each side of the dorsal line; the front half of the flap is shiny and black, and has some conical tubercles of different sizes all over it, each surmounted by a single fine hair, there being one subdorsal tubercle larger than the rest; the posterior half is green and smooth except for the tubercle above the extremity just mentioned; the body is somewhat stouter in the middle; the head is broader than the body at segment 2. Head round, shiny, oily yellow

all over, with a rather large and rather narrow triangular clypeus, the labrum and antennæ coloured like the head; the surface covered with small, conical, setiferous, black tubercles, three on each side of the dorsal line on the vertex, two on the border of the clypeus at the apex on each side, and one above the apex on each side of the central line, about eight on each lobe besides, in addition to which there are several small cylindrical points, all, tubercles and points, with a surmounting fine hair. Surface of body rugose with six transverse rows, from above the spiracular region over the dorsum, of small, shiny, conical, setiferous, black tubercles to each segment; segments 2, 12 and 13 have only a few transverse rows of such tubercles; the front row of each segment is generally composed of larger tubercles than the others, and especially the subdorsal tubercle of that first row is generally large, the tubercles of segment 2 nearly render the whole segment black; the surface is shiny as well as the tubercles, and has besides a few cylindrical, setiferous, black points. Spiracles of the ordinary size, flush, oval and white. The colour of the body is a rather light green, sometimes with a tinge of lilac, with a yellow-white, spiracular, narrow band from segment 2/3 to segment 12, where the band expands somewhat. The black tubercles may sometimes be very small, just black specks. The eyes are only four in number on each side, and are arranged in an arc above the base of the antennæ, they are shiny, of the same colour as the head, and are generally bordered with black. Length 30 mm., breadth 3.75 mm.

**PUPA.** The pupa is very like that of *A. taprobana*; the head-process from between the eyes is long, flattened at the sides, slightly curved, pointed at the extremity and directed upwards and forwards, sometimes straight out in a line with the axis, sometimes inclined to it; it is as long as segments 4 and 5 (in the dorsal line) together; and the edges on the ventral surface are minutely serrated. The front margin of segment 2 is produced into a small subdorsal tooth, and the dorsal line is rather strongly carinated; the thorax is rather highly carinated on the dorsal line, the lateral outline of this carina being a curve which is slightly broken at the apex, just before which the carina is double, and the edges somewhat minutely serrate; the lateral teeth of segments 6, 7 and 8 are all the same size and pointed; the dorsal line of the abdomen from segment 6/7 somewhat carinated, the carination splitting down the sides of the cremaster on segment 14; the cremaster is rather small, square as seen from above, slightly bifid, with the lateral carina, which is continued forwards on to segments 11, 12 and 13. The spiracles of segment 2 are thin, yellow lines, the other spiracles are oval, flush, and white. The surface of the pupa is shiny, smooth except for a

superficial wrinkling, the carinæ, and the teeth; there is a round, blunt, low production of the shoulder. The colour of the pupa is dirty whitish with a pink shade on segments 4 to 14; the same but transparent-looking on the rest; the head-production, the points on segment 2, the teeth of segments 5 to 7 (sometimes), and the extremity of the cremaster are black—only the top and lower edge of the point of the head however; there is a black spot on the hinder edge of segment 2 dorsally, one just behind the shoulder, one lateral on segments 3 and 4 to 12, and one dorsal on the front margin of segments 9 and 10. There is always a semicircle of six darkish spots dorsally on segments 6 and 7. The colour of the pupa when formed under a leaf is probably green, with the markings as above. The underside or ventrum of the pupa is always whitish. Length 21.25 mm., of which the process on the head is 2.75 mm., breadth at shoulders 5 mm., breadth at segment 7 from tip to tip of teeth 7.5 mm.

**HABITS.** The habits of the larva are those of *A. taprobana*. The pupa is formed on the underside of a leaf, on the trunk of the tree, or on any flat surface, and is attached by the tail and by a body-band.

166. *APPIAS WARDII*, Moore.

*Capparis Heyneana*, Wall. (*Capparidæ*).

Recorded by Dr. Butler, l.c., p. 398, n. 12, from the Nilgiris, Mysore, and Rangoon. The latter locality is certainly erroneous. The species is confined to South India.

167. *HUPHINA NERISSA*, Fabricius.

*Capparis sepiaria*, Linn. (*Capparidæ*).

*Capparis horrida*, Linn. f. (*Capparidæ*).

*H. nerissa* is the parent form of this group of this genus occurring in India, but typically it is not found in South India, being represented there by *H. phryne*, Fabricius, under which name it appears in the second Kanara list, p. 574, n. 158.

168. *HUPHINA REMBA*, Moore.

*Capparis Heyneana*, Wall. (*Capparidæ*).

169. *BELENOIS MESENTINA*, Cramer.

*Capparis divaricata*, Lamk. (*Capparidæ*).

Subfamily **PAPILIONINÆ.**

170. *TROIDES MINOS*, Cramer.

*Aristolochia indica*, Linn. (*Aristolochiaceæ*).



The generic name *Ornithoptera*, under which this species is given in the Kanara papers, is a synonym of *Troides*.

171. PAPILIO HECTOR, Linnæus.

*Aristolochia indica*, Linn. (*Aristolochiaceæ*).

172. PAPILIO ARISTOLOCHIZÆ, Fabricius.

*Aristolochia bracteata*, Retz. (*Aristolochiaceæ*).

*Aristolochia indica*, Linn. (*Aristolochiaceæ*).

The food-plant of this butterfly, *Aristolochia*, Linnæus, must apparently have been known to Fabricius in Europe in 1775, more than a century and a quarter ago, when he described the insect, and probably named it after the pabulum of the larva.

173. PAPILIO AGAMEMNON, Linnæus.

*Unona discolor*, Vahl (*Anonaceæ*).

*Polyalthia longifolia*, Benth. and H. f.\* (*Anonaceæ*).

*Anona squamosa*, Linn. (*Anonaceæ*).

*Anona reticulata*, Linn. (*Anonaceæ*).

*Saccopetalum tomentosum*, Hook. f. and T. (*Anonaceæ*).

174. PAPILIO SARPEDON TEREDON, Felder.

*Cinnamomum zeylanicum*, Breyn (*Laurineæ*).

*Alseodaphne semecarpifolia*, Nees (*Laurineæ*).

*Itissæu sebifera*, Pers. (*Laurineæ*).

An aberration of this species has been described by Colonel Swinhoe from Matheran in South India as a distinct species under the name of *Delchina* [sic] *thermodusa*. It has the anterior blue spot of the median band of the forewing absent. This aberration is found also in Ceylon.

175. PAPILIO EURYPYLUS JASON, Esper.

*Unona Lawii*, Hook. f. and T. (*Anonaceæ*).

*Saccopetalum tomentosum*, Hook. f. and T. (*Anonaceæ*).

In the first Kanara paper, p. 364, this species appears under the name *Papilio doson*, Felder, and in the second, p. 578, as *Papilio telephus*, Felder, these two species being given by the Hon. Walter Rothschild in Nov. Zool., vol. ii, p. 432 (1895) as synonyms of *Papilio eurypylus jason*, Esper.

176. PAPILIO NOMIUS, Esper.

*Saccopetalum tomentosum*, Hook. f. and T. (*Anonaceæ*).

\* In the first Kanara paper, p. 363, this plant is given under its synonymic name *Gualteria* [recte *Guatteria*] *longifolia*, Wall.

177. *PAPILIO ANTIPHATES ALCIBIADES*, Fabricius.

*Unona Lawii*, Hook. f. and T. (*Anonacæ*).

178. *PAPILIO DEMOLEUS*, Linnæus.

*Ruta graveolens*, Linn., var. *angustifolia*, Pers. (*Rutacæ*).

*Glycosmis pentaphylla*, Correa (*Rutacæ*).

*Murraya Kœnigii*, Spreng. (*Rutacæ*).

*Citrus decumana*, Linn. (*Rutacæ*).

*Ægle Marmelos*, Correa (*Rutacæ*).

In the Kanara papers this species is given under its synonymic name *P. erithonius*, Cramer.

179. *PAPILIO POLYTES*, Linnæus.

*Zanthoxylum Rhetsa*, DC. (*Rutacæ*).

*Glycosmis pentaphylla*, Correa (*Rutacæ*).

*Citrus medica*, Linn. (*Rutacæ*).

*Citrus decumana*, Linn. (*Rutacæ*).

180. *PAPILIO POLYMNESTOR*, Cramer.\*

*Paramignya monophylla*, Wight (*Rutacæ*).

*Atalantia monophylla*, Correa (*Rutacæ*).

181. *PAPILIO HELENUS DAKSHA*, Hampson.

*Zanthoxylum Rhetsa*, DC. (*Rutacæ*).

*Glycosmis pentaphylla*, Correa (*Rutacæ*).

*Citrus medica*, Linn. (*Rutacæ*).

*Citrus decumana*, Linn. (*Rutacæ*).

182. *PAPILIO DEMOLION LIOMEDON*, Moore.

*Evodia Roxburghiana*, Benth. (*Rutacæ*).

*Acronychia laurifolia*, Blume (*Rutacæ*).

183. *PAPILIO PARIS TAMILANA*, Moore.

*Evodia Roxburghiana*, Benth. (*Rutacæ*).

Though Mr. Bell have given me the name of the food-plant of the larva of this splendid butterfly, the largest of its group, he has not furnished me with a description of its transformations. He has only seen the female laying eggs on the plant named.

\* In the first Kanara paper, p. 367, one of the food-plants of this butterfly is given as *Garcinia Xanthochymus*, Hook. f. (*Guttiferæ*), but Mr. Bell considers this record to be incorrect.

## 184. PAPILIO BUDDHA, Westwood.

*Zanthoxylum Rhetsa*, DC. (*Rutaceæ*).

## 185. PAPILIO ABRISA, Kirby.

*Glycosmis pentaphylla*, Correa (*Rutaceæ*).*Alseodaphne semecarpifolia*, Nees (*Laurineæ*).

## 186. PAPILIO CLYTIA, Linnæus.

*Cinnamomum zeylanicum*, Breyn (*Laurineæ*).*Alseodaphne semecarpifolia*, Nees (*Laurineæ*).*Litsea tomentosa*, Herb.\* (*Laurineæ*), in Bombay.*Litsea sebifera*, Pers. (*Laurineæ*).

In the two Kanara papers this butterfly appears as *Papilio dissimilis*, Linnæus, or *P. panope*, Linnæus, but the Hon. W. Rothschild has recently shewn that *P. clytia* is the oldest name for it.

## 187. PAPILIO PANDIYANA, Moore.

This is the only *Papilio* in Kanara of which the food-plant has not been discovered. The allied *P. jophon*, Gray, of Ceylon, has been bred, but its food-plant has not been recorded. The larva shews that this butterfly comes into the first group of the genus, being very similar to that of *P. hector*, Linnæus, and *P. aristolochiæ*, Fabricius, and probably feeds on the same plants.

## Family HESPERIIDÆ.

## 188. ISMENE GOMATA, Moore.

*Heptapleurum venulosum*, Seem. (*Araliaceæ*).

## 189. ISMENE FERGUSONII, de Nicéville.

*Combretum extensum*, Roxb. (*Combretaceæ*).

## 190. BIBASIS SENA, Moore.

*Combretum extensum*, Roxb. (*Combretaceæ*).191. HASORA (*Parata*) ALEXIS, Fabricius.*Pongamia glabra*, Vent. (*Leguminosæ*).

Dr. Chr. Aurivillius in Ent. Tids., vol. xviii, p. 150, n. 68 (1897), has recently shewn that "*Hesperia*" *alexis*, Fabricius, is an older name

\* In the first Kanara paper, p. 369, this plant is mentioned under *Tetranthera apetala*, Dalz. and Gibs., which is given by Sir J. Hooker as a synonym of *Litsea tomentosa*, Herb.

for the "*Papilio*" *chromus* of Cramer, under which this species appears in the Kanara papers.

**LARVA.** Head squarely rounded as seen from the front, moderately thick through; covered with rather long, erect, light hairs; the colour is yellow or red-fuscous; when yellow a black spot (the eyes) at the base of each lobe just above the jaws; head slightly bilobed. Segment 2 is smaller than the head, and has a dorsal, broad, black collar; it is often greenish when it has two black, lateral spots. The shape is cylindrical, the section being circular, the anal end slightly sloping and finishing off round; the last segment has a shiny, dorsal, black shield at the end. The spiracles are rather long ovals, large and white. The body is sparsely covered with rather long, erect, white hair. The colour is a more or less dark mauve on the dorsal half-segments, suffused with whitey-yellow dorsally; there is a dorsal, pure mauve line, and a more or less indistinct subdorsal pure mauve line; as also a broad, latero-marginal band of yellowish-green bordered above and below by a white line. Ventrums greenish-yellow. The larva is oily looking. There may be a lateral, black spot on each or any of segments 5 to 9.

**PUPA.** Head high, somewhat bowed, with a conical boss on the vertex, pointing upwards and forwards, between the eyes; the eyes are very prominent. Segment 2 broad. Thorax stout, convex, humped in the usual way; shoulders somewhat narrower than the head. Section of body circular. The pupa decreases evenly in diameter from the shoulders to the end, with a slight dorsal constriction to the cremaster, which is small and nearly cubical. The last segment before the end is broad dorsally, but disappears laterally, and is raised on the front margin above the margin of the next segment, with a triangular indentation dorsally. Segment 14 shows as a semicircular dorsal shield-like piece, deeply indented on the dorsal line. Spiracles rather large, rather long ovals, light brown in colour, the spiracle of segment 2 linear. Surface shiny, widely and finely wrinkled, covered with more or less numerous hairs, erect on the anterior part of the body, adpressed on the posterior part; ventrally on abdomen the hairs are erect. Colour green, generally sprinkled with white powder, with a yellowish tinge on the abdomen; the depressions of segments 13 and 14 edged with shiny black. The pupa is attached by the tail and a body-band.

**HABITS.** The larva feeds on young leaves, and makes a loose cell by bringing the two edges of a leaflet together laxly. It pupates in such a cell. It is very moth-like in its habits; the larva runs out of its cell when disturbed. The pupa wriggles considerably when touched.

192. *HASOKA* (*Parata*) BUTLERI, Aurivillius.  
*Derris scandens*, Benth. (*Leguminosæ*).

*Derris Heyneana*, Benth. (*Leguminosae*).

Dr. Chr. Aurivillius in the above-cited paper renames the *Hasora alexis* of Butler, but not of Fabricius—*Hasora butleri*. Messrs. Elwes and Edwards in *Trans. Zool. Soc. Lond.*, vol. xiv, p. 301 (1897), cite Moore's figure of *Parata alexis* in *Lep. Cey.* as a synonym of *Hasora chromus*, Cramer, = *H. alexis*, Fabricius, but make no reference to Fabricius' original description or Butler's figure of *H. alexis*. The very broad, clearly defined, discal, white band of the hindwing on the underside will separate *H. butleri* from *H. alexis*.

**LARVA.** The exact type of *Hasora (Parata) alexis*, Fabricius. Head from in front nearly circular, slightly, though distinctly, indented on the vertex; under a lens the surface is irregularly rugose, covered sparsely, with the exception of the upper part of the face and the vertex, with long, fine, erect, white hairs; colour very dark brown, with reddish jaws; the head is shiny, small for the body as compared with other hesperids. Segment 2 is narrower than the head, and is shiny dark brown, with a double, dorsal, greenish line and some long hairs as on the head. Segment 3 as broad as the head from the front margin. The larva is fat and greasy-looking, thickest about segments 6 to 9, after which its diameter decreases very gradually to the broadly rounded, sloping, anal segment. The transverse section of the body is circular. The spiracles are very small, oval in shape, yellow. The surface of the body is sparsely hairy, the hairs are fine, long, erect and white, most thickly disposed round the margin of the larva; otherwise the larva is quite smooth. Colour green, suffused dorsally as far as a lateral yellow line with rather dark violet; a dorsal, dark green line bordered by a yellow line on each side, and a subdorsal line of the same colour, so that there are four parallel dorsal lines altogether; a marginal yellow line; all these lines are not continued on to the yellowish-green anal segment; a black spot laterally just outside the subdorsal line on segments 6, 8, 10 and 12; this spot under a lens is velvety-looking. The ventrum is green. Length 32 mm. when the larva is walking, breadth 6.3 mm. at the broadest part, height 6.3 mm.

**PUPA.** The exact counterpart of that of *H. alexis* in shape and colour. A very slight boss between the eyes, a small oblong space just above the boss and between the bases of the antennæ, just touching these bases and not reaching the front margin of segment 2, dark brown-green in colour consequent on being free from the white powder which covers the whole pupa. Spiracles oval and black. The whole surface of the body is rather sparsely pitted and covered with rather long, fine, white hairs, which are semi-adpressed to the surface, these hairs spring from the pits, one from each, and are densest on the eyes. The cremaster is short,

stout, oblong, slightly curved and black. The last segment before the cremaster is roundly indented in the middle of the front margin, and the indentation is lined with black. The colour through the white powder is green on the thorax and pink on the abdomen. The only black markings are the spiracles, the markings above mentioned on the last segments, and a dorsal black line from the front margin of the thorax a third of the whole length of the thorax towards the hinder margin. Length 23 mm., breadth at shoulders (which are slightly angulated and the broadest part of the pupa) 6.3 mm., the height of the thorax (which is the highest part of the pupa) 6.3 mm.

**HABITS.** The habits of the larva are exactly those of *H. alexis*. The cell is composed of a few tender, soft leaves joined together loosely by an irregular web, which web is also generally spun over the mouth of the cell or shelter; the pupa is formed in the cell. The larvæ are much eaten by spiders; and are greatly attacked by parasitic *Diptera* and *Hymenoptera*. The eggs are laid on the young white leaves (the leaves of the food-plant are sometimes rose or rose-brown in colour) in a shady place, very often high up amongst the foliage of the trees amongst which the creeper climbs, often to a great height. The larva has always been found at an elevation of 900 to 1000 feet above sea level.

193. *HASORA CHABRONA*, Plötz.

*Millettia racemosa*, Benth. (*Leguminosæ*).

**EGG.** The egg is very small for so large a hesperid, and is red or pink when first laid.

**LARVA.** Head rather square, broader than high, thick through, not very large for the body, rather flat on the face; the top quarter of the head red-brown in colour, the rest black, the jaws yellow and black. Segment 2 smaller than the head, shiny, smooth, swollen-looking, white in colour, with a dorsal and a lateral black band, and a marginal brown spot laterally. Body cylindrical, increasing rapidly in width from the collar to segment 4, then gradually to the middle which is the broadest part; the anal segment rather narrow, overhanging the legs, sloping, with the extremity rounded, and dorsally black and shiny. The surface of the body covered throughout with long, very fine, white hairs, each segment with four transverse fine yellowish lines. Colour of larva dirty bluish-green, with four subdorsal, broad, yellow lines, two on each side, besides a marginal and submarginal yellow line; the dirty ground-colour is spotted finely with yellow. Length 33 mm.

**PUPA.** Very like that of *Hasora (Parata) alexis*, Fabricius, but light pink on the abdomen, dirty green-white on the wings, thorax and head. The point on the head between the eyes is short and sharply

conical. Cremaster oblong, stout, thicker than broad. The spiracle of segment 2 with a flush, rather large, oval, black surface near it. Spiracles oval, large and black. Surface pitted all over, an erect short hair being placed in each pit, these hairs are not very short, and are longest on the head, eyes, and segment 2. Thorax stout, the constriction behind the thorax slight. A long, dorsal, black streak on the front slope of the thorax reaching its front margin, and a short, dorsal, black mark on the hinder margin; a dorsal, black mark on segment 13; cremaster black; two black spots on the inner margin of each eye; the point on the head black. The entire pupa is covered with a white powder. Length 25.3 mm., breadth at the thorax or at segment 7 is 7 mm., height at the apex of the thorax 7 mm.

HABITS. The habits are similar to those of *H. alexis* in nearly all particulars.

194. *HASORA BADRA*, Moore.

*Derris uliginosa*, Benth. (*Leguminosæ*).

LARVA. The larva is most like that of *Hasora chabrona*, Plötz, but differs in markings and coloration. It is circular in transverse section, thickest in the middle and rather stout. The head seen from the front is nearly round and somewhat bilobed, there being a depressed line over the vertex to the apex of the clypeus; it is finely rugose, and has a covering of fine, rather long, erect, white hairs which are not very densely disposed; the colour is dark rose-red with the clypeus black, and a black patch, varying a good deal in size, on the front face of each lobe at the base and reaching as far as the centre; the eyes are also black; the jaws tipped with white; the head is of the ordinary size for the larva of the genus *Hasora*. Segment 2 is shiny black. Segments 13 and 14 are dirty white, the anal segment slopes in the dorsal line at an angle of more than 45° with the longitudinal axis, and is broadly rounded at the extremity. The surface of the body is dull, covered all over, but not very densely, with fine, moderately long, erect, white hairs. Spiracles oval, of the ordinary size, and yellowish. The colour is light neutral tint, with a double subdorsal line on each side running from segment 3 to segment 12, both rather ill-defined as to outline and running together in places; five or six thin lines on each segment running across transversely to the length of the body from just above the spiracle on each side; all these lines yellow; on segments 3, 4, 6, 10 and 12 is a large lateral deep purple spot or patch interrupting the anterior pair of the transverse yellow lines; on segments 5, 7, 9 and 11 there is a deep purple line between the anterior pair of transverse yellow lines in the same position as the deep purple patch on segments 3, 4, 6, 10 and 12;

there is a subspiracular white line; the ventrum is white with a slight indigo-blue wash in the colour. Length 38 mm. when at rest, breadth 6 mm.

**PUPA.** The pupa is nearly exactly the same as that of *Hasora* (*Parata*) *alexis*, Fabricius; it has, however, a longer snout. The eyes are prominent, and the front of the head (the front of the pupa) is square, except that the vertex is produced into a triangular piece as seen from above, really a short cone surmounted by a porrect, rather long, cylindrical, blunt-topped snout directed slightly upwards, which is as long as segment 2 is broad (breadth in the direction of the longitudinal axis of the pupa); segment 2 is broad and convex, with its dorsal line at an angle of  $45^\circ$  to the longitudinal axis; the thorax is lumped, and the front slope is at a greater angle to the longitudinal axis than segment 2, the back slope being nearly parallel to that axis; the body is slightly constricted before the shoulders in lateral outline, and also at segment 4; the pupa is thickest in the middle, though only slightly more so than at the thorax, the shoulders are evenly rounded and not prominent; the pupa is circular in section decreasing in diameter from the middle to the anal end, where the stout parallel-pipedal cremaster runs up on to the anal segment in a lateral pear-shaped piece; segment 12 has a dorsal convex shield, with a dorsal semicircular notch in it. The spiracles of segment 2 are indicated by a conical black tubercle on the front margin of the thorax; and the other spiracles are oval and black. The surface of the body is covered all over with a white powder, and is shiny beneath this powder where visible. The colour is a very pale green, with a black patch round each spiracle; there is an oval, blob-like, black patch at the front and hinder margins of the thorax in the dorsal line; a black spot above and below on the front of each eye; a black border to the lateral pieces of the cremaster and to the dorsal shield of segment 12; and the snout is rugose and black. Length 28 mm. over all, length of snout 2.25 mm., breadth at centre 7 mm., height at centre 7 mm., breadth of front of head 5 mm.

**HABITS.** The larva makes a cell, similar to that of all the other species of *Hasora*, of young leaves loosely bound together with silk web, and feeds, whilst young, on the young leaves, though, when full grown, it will feed on the fully matured leaves. The pupa is formed in the cell, which is thinly covered inside with silk. It is attached by the tail and by a body-band.

195. *BADAMIA EXCLAMATIONIS*, Fabricius.  
*Terminalia Bellerica*, Roxb. (*Combretaceæ*).  
*Combretum extensum*, Roxb. (*Combretaceæ*).



196. *HESPERIA GALBA*, Fabricius.  
*Waltheria indica*, Linn. (*Sterculiaceæ*).

197. *CAPRONA RANSONNETII*, Felder.  
*Helicteres Isora*, Linn. (*Sterculiaceæ*).

198. *ODONTOPTILUM ANGULATA*, Felder.  
*Allophylus Cobbe*, Blume (*Sapindaceæ*).

199. *COLADENIA INDRANI*, Moore.  
*Grewia Microcos*, Linn. (*Tiliaceæ*).  
*Xylia dolabriformis*, Benth. (*Leguminosæ*).  
*Mallotus philippinensis*, Muell. (*Euphorbiaceæ*).

This species is given under *Coladenia tissa*, Moore, in the second Kanara paper. I have given my reasons in Journ. A.S.B., vol. lxviii, pt. 2, p. 225, n. 190 (1899) for considering *C. indrani* and *C. tissa* to represent a single species.

200. *COLADENIA DAN*, Fabricius.  
*Cyathula prostrata*, Blume (*Amarantaceæ*).  
*Achyranthes aspera*, Linn. (*Amarantaceæ*).  
*Achyranthes bidentata*, Blume (*Amarantaceæ*).

201. *SATARUPA BHAGAVA*, Moore.

Mr. Bell obtained a single male at Anshi on 27th December, 1898. It is new to the Kanara list, and has not been bred. Messrs. Elwes and Edwards do not record it from South India at all, but it occurs in Orissa and the Nilgiri Hills.

202. *SARANGESA PURENDRA*, Moore.  
*Blepharis asperima*, Nees (*Acanthaceæ*).

203. *SARANGESA DASAHARA*, Moore.  
*Achyranthes aspera*, Linn. (*Amarantaceæ*).  
An unidentified Acanthad.

Mr. Bell notes that *Coladenia dan*, Fabricius, and *S. dasahara* are so much alike in the larval and pupal states that they should certainly not be generically separated. The larva of *Sarangesa purendra*, Moore, only differs from them in colour, but feeds on a different food-plant to the other species mentioned above.

204. *TAPRNA THWAITESI*, Moore.  
*Dalbergia latifolia*, Roxb. (*Leguminosæ*).

*Dalbergia rubiginosa*, Roxb. (*Leguminosæ*).

*Dalbergia tamarindifolia*, Roxb. (*Leguminosæ*).

*Dalbergia volubilis*, Roxb. (*Leguminosæ*).

*Derris scandens*, Benth. (*Leguminosæ*).

Messrs. Elwes and Edwards (l.c., p. 147, pls. xviii, fig. 19, male; xxii, fig. 16, inner face of left clasp of male) describe *Tapena hampsoni* as a species distinct from *T. thwaitesi*, from the Nilgiris and N. Canara. As, however, they say they have never seen typical *T. thwaitesi* from Ceylon, it is probable that their *T. hampsoni* is a synonym of that species.

205. *CELÆNORRHINUS LEUCOCERA*, Kollar.

*Dædalacanthus roseus*, T. Anders. (*Acanthaceæ*).

*Eranthemum* sp. (*Acanthaceæ*).

206. *CELÆNORRHINUS AMBAREESA*, Moore.

*Strobilanthes callosus*, Nees (*Acanthaceæ*).

207. *CELÆNORRHINUS FUSCA*, Hampson.

*Strobilanthes callosus*, Nees (*Acanthaceæ*).

Messrs. Elwes and Edwards place "*Plesioneura*" *fusca* as a synonym of *Celænorrhinus spilothyrus*, Felder, with a query, and record it from North Canara.

208. *TAGIADES ATTICUS*, Fabricius.

*Dioscorea pentaphylla*, Linn. (*Dioscoreaceæ*).

*Smilax macrophylla*, Roxb. (*Liliaceæ*).

209. *TAGIADES OBSCURUS*, Mabille.

*Dioscorea pentaphylla*, Linn. (*Dioscoreaceæ*).

I have no specimens of this species from Kanara.

210. *TAGIADES ALICA*, Moore.

Messrs. Elwes and Edwards (l.c., p. 140), record this species from N. Canara, this being the only locality in South India given by them for it; elsewhere they record it from Burma, the Andaman Isles, the Malay Peninsula, and Pulo Laut near Borneo. In my collection there is a good series of both sexes of this species from Kanara. It is probable that the *T. obscurus*, Mabille, recorded from Kanara, is wrongly identified. It has not been bred, unless, as is probable, the transformations recorded for *T. obscurus* really apply to this species.

211. *CUPITHA PURREEA*, Moore.

*Terminalia Bellerica*, Roxb. (*Combretaceæ*).

*Terminalia paniculata*, Roth. (*Combretaceæ*).

*Combretum ovalifolium*, Roxb. (*Combretaceæ*).

This curious little butterfly has a wide distribution, being found in South India (Kanara and the Nilgiri Hills), in Orissa, the Eastern Himalayas, Assam, Burma, the Andaman Isles, Sumatra, Nias, Java, Bali, Borneo, Celebes, and the Philippine Isles.

212. MATAPA ARIA, Moore.\*

*Bambusa arundinacea*, Willd. (*Gramineæ*).

*Dendrocalamus strictus*, Nees (*Gramineæ*).

*Ochlandra stridula*, Thwaites (*Gramineæ*).

213. GANGARA THYRSIS, Fabricius.†

*Areca catechu*, Linn. (*Palmææ*).

*Caryota urens*, Linn. (*Palmææ*).

*Phoenix sylvestris*, Roxb. (*Palmææ*).

*Calamus pseudo-tenuis*, Becc. and Hook. f. (*Palmææ*).

*Cocos nucifera*, Linn. (*Palmææ*).

214. PADRAONA DARA, Kollar.\*

*Bambusa arundinacea*, Willd. (*Gramineæ*).

*Oxytenanthera monostigma*, Beddome (*Gramineæ*).

*Ochlandra stridula*, Thwaites (*Gramineæ*).

215. IAMBRIX SALSALA, Moore.

Grasses (*Gramineæ*).

*Bambusa arundinacea*, Willd. (*Gramineæ*).

216. BAORIS (*Parnara*) GUTTATUS, Bremer and Grey.

*Oryza sativa*, Linn. (*Gramineæ*).

Grasses (*Gramineæ*).

This is the *Baoris bada*, Moore, of the second Kanara list, p. 45, n. 204, placed by Messrs. Elwes and Edwards (l.c., p. 281) as a synonym of *Parnara guttatus*. *Baoris* (*Parnara*) *philotas*, de Nicéville, of the second list, p. 47, n. 207, is believed to be a synonym of this species by Mr. Bell, who says that starved larvæ of *B. guttatus* produce *B. philotas*. See also *Baoris* (*Parnara*) *bevani*, Moore, No. 239, *infra*.

\* In the second Kanara paper, pp. 42, 44, the food-plant of this species is given as *Teinostachyum*. It should be *Ochlandra*.

† In the second Kanara list, p. 48, *Calamus Rotang*, Linn. (*Palmææ*), is given as the food-plant of this species, but Mr. Bell informs me that this cane is not found in the district, though Sir J. Hooker gives it from the Deccan Peninsula and Ceylon.

217. *SUASTUS GREMIUS*, Fabricius.*Areca Catechu*, Linn. (*Palmæe*).*Caryota urens*, Linn. (*Palmæe*).*Phoenix sylvestris*, Roxb. (*Palmæe*).*Calamus pseudo-tenuis*, Becc. and Hook. f. (*Palmæe*).*Cocos nucifera*, Linn. (*Palmæe*).218. *PEDESTES SUBMACULATA*, Staudinger.*Calamus pseudo-tenuis*, Becc. and Hook. f. (*Palmæe*).

This butterfly appears in the second Kanara list, p. 47, n. 206, as *Isma submaculata*, Staudinger. In Trans. Zool. Soc. Lond., vol. xiv, p. 230 (1897), Messrs. Elwes and Edwards place it in the genus *Platingia*, in which it was originally described, but say that they have not seen a specimen of it. On page 193 they describe *Pedestes maculicornis* as a new species from Pulo Laut, near Borneo. In my opinion this species is a synonym of *P. submaculata*. In my collection there are specimens of it from Kanara, Cachar, the Daunat Range of Middle Tenasserim in Burma, Perak in the Malay Peninsula, and Pulo Laut. It was originally described from Palawan in the Philippines. In spite of the key to the species of the genus *Pedestes* given by Messrs. Elwes and Edwards on p. 193, I am unable to separate *P. fuscicornis*, described by those gentlemen also from Pulo Laut, from their *P. maculicornis*.

**EGG.** The egg is laid on the underside of the leaves. It is dome-shaped, standing on a narrow band. It has sixteen "meridians" which start from the top of the band and run towards the top of the dome; these meridians are thin and raised above the surface. The surface is very finely lined transversely to the meridians. The colour is greenish, with the meridians brown. As the egg found was empty, the larva having eaten its way out of the top and made a large hole, the fact as to whether the meridians meet at the top of the egg or not cannot be stated. Breadth 0·8 mm.

**LARVA.** The head is semi-elliptical in shape, slightly rough as to surface, somewhat shiny, very light yellow-brown in colour, with a dark brown band round the back (not visible from the front view) just reaching the jaws; a brown medial line splitting down the sides of the clypeus, and a medial brownish line, broadest in the middle of its length, on each lobe of the face, starting from the clypeus and diverging from the medial line of the face and nearly reaching the vertex of the lobe; the jaws and the lower parts of the clypeus dark brown; the head is much larger than the second segment. Body broadest at segment 5, sub-cylindrical in shape; the last segment, ending semicircularly, is sloping and rather large, slightly corrugated on the dorsum towards the

posterior margin, and with a small, lateral, round, tubercular, light yellow-brown spot. All the segments are clearly distinguished. The spiracles are of the ordinary size, rather round (actually slightly oval), light yellowish-brown in colour. Each segment has a good many colourless glassy-looking spots towards its front margin; these spots are small but are clearly visible under a lens. The surface of the body is finely frosted and dull, destitute of hairs except round the margin of segment 14. General colour of the larva bluish-greenish-white, beneath yellowish-green. Total length 22 mm.

**PUPA.** Like that of *Suastus gremius*, Fabricius. Head as broad, if not broader, than at the shoulders, and is, together with the segment 2, very large for the pupa, and is slightly bowed. Thorax rather short, strong, convex, but only slightly humped. Body of the same breadth from the shoulders to segment 8 and then tapering to the end; constricted between segments 2 and 3; the body is circular in transverse section from segment 3 to segment 13. Spiracular expansion of segment 2 large, nearly flush with the thorax, semicircular in shape (the straight side facing forwards); dark red-brown in colour. Spiracles small, linear, dark red-brown. Surface of the body finely rugose. Eyes and cremaster covered with short, erect hairs; surface of pupa bearing short, erect hairs as seen under a lens, with slightly longer hairs on the posterior portion. Cremaster hexagonal, small, with next to no suspensory hairs, brown. The pupa has the head green with a shade of brown, the thorax is green, and the abdomen waxy yellow; the surface is covered with a white powder. The cell in which it is formed is tightly closed, and the pupa is attached very slightly by the tail only.

**HABITS.** The habits of the larva are similar to those of *S. gremius*, the cell being made tightly, clothed with silk inside, and the edges eaten in crenulations. The larva eats above the cell towards the point of the leaf leaving the midrib, and pupates in the cell. Great quantities of old cells are found, pointing to the fact that the larvae are very liable to the attack of enemies. The food-plants were always found in dark shady evergreen jungle. The pupa-cell is cut free by the larva before pupation and falls to the ground, and no pupa is therefore ever found except among rubbish at the foot of the plant.

219. HALPE ASTIGMATA, Swinhoe.

This species has never been bred.

220. HALPE CEYLONICA, Moore.

*Bambusa arundinacea*, Willd. (*Gramineæ*).

*Oxytenanthera monostigma*, Beddome (*Gramineæ*).

This butterfly is given in the second Kanara list as *Halpe moorei*, Watson, as well as *H. ceylonica*, the former appears to me to be a synonym of the latter. In describing *H. moorei*, Watson does not refer to *H. ceylonica*, except to give it in his list of the species of the genus as a distinct species.

221. HALPE MONOREI, de Nicéville.

*Dendrocalamus strictus*, Nees (*Gramineæ*).

222. HALPE HYRTACUS, de Nicéville.

*Oxytenanthera monostigma*, Beddome (*Gramineæ*).

*Ochlandra stridula*, Thwaites (*Gramineæ*).

LARVA. The head of the larva is the same shape as those of the genus *Baoris*; it is nearly round, slightly indented on the top, convex on the face, thick through, rugose as to the surface, and finely hairy all over, the hairs rather short; the clypeus and about the jaws, the whole margin of the head as well as all the hinder part, and a central broad band—all very dark brown; the rest of the head dirty yellow. Body of the usual shape of *Baoris*, the anal segment rounded at the extremity; that segment covered all over with star-shaped reddish-brown spots, from each of which springs a short seta. Spiracles small, oval, a little darker than the colour of the body. Surface of the body covered with short, erect, fine, colourless hairs, which are rather longer on the anal margin than elsewhere. The colour of the larva is a transparent greenish dirty yellow, with a brown tinge on the hinder segments; a dorsal dark green line. The body is finely folded at the margins of the segments. Length 28 to 38 mm.

PUPA. The pupa has the head bowed, square in front, perfectly parallel-sided, much broader transversely to the length of the pupa than in the direction of that length, nearly as broad as the thorax at the shoulders; there is a slight boss between the eyes, with erect, rather long, light hairs in front and around the eyes. Segment 2 narrow, parallel-sided. Thorax only slightly humped, its front slope in the same line of ascent as the head and segment 2, twice the diameter of segment 2 (in the sense of the pupal height) at the apex, evenly convex, rounded at the shoulders; the apex is the highest and the shoulders the broadest part of the body. The transverse section of the body is circular from the shoulders to the anal end, which narrows off into the rather short and triangular cremaster; the cremaster has a rounded extremity, is perfectly flat beneath, nearly perfectly wedge-shaped, with feebly developed dorsal sustensor ridges, and a tuft of suspensory hairs

on the upperside of the rounded extremity; the cremaster is hollowed out at each side at its base as in the pupa of *Baracus hamptoni*, Elwes and Edwards. Spiracles narrow, oval, small, of a darker yellow colour than the body. The spiracular expansions of segment 2 large, kidney-shaped, with the round side backwards, the edge slightly raised above the body, strainer-shaped as to the hollow area, rugose on the surface, facing forwards and outwards, very conspicuous, dark brown. The surface of the body is covered thickly all over with semi-erect, short, light hairs; the surface is irregularly and finely rugose. The colour of the pupa is a brownish-red, light, dirty yellow, with a lateral dark smudge along each side of the thorax, as well as some dark spots; each abdominal segment from 6 to 12 having two transverse rows of small, dark spots. The pupa is stout, very similar in shape to that of *Telicota bambusæ*, Moore. The proboscis does not extend in the least beyond the wing-cases. It is suspended by the tail only. Length 22 mm., breadth 5.5 mm.

**HABITS.** The habits of the larva are those of *T. bambusæ* in as far as the cell-making is concerned. It is just as sluggish, or even more so, in its movements; and does not excrete any cereous matter in the cell prior to changing to a pupa.

223. *TELICOTA BAMBUSÆ*, Moore.

*Bambusa arundinacea*, Willd. (*Gramineæ*).

*Oxytenanthera monostigma*, Beddome (*Gramineæ*).

224. *BARACUS HAMPSONI*, Elwes and Edwards.

A very long-leaved soft grass (*Gramineæ*).

This butterfly is given in the second Kanara list as *B. septentrionum*, Wood-Mason and de Nicéville, a species restricted by Messrs. Elwes and Edwards to Sikkim and the Shan hills of Upper Burma, but it is found also in Cachar, and in Middle Tenasserim of Lower Burma. *B. hamptoni* was described from N. Canara, but it occurs also on the Nilgiri Hills.

225. *TARACTROCERA CERAMAS*, Hewitson.

Grasses (*Gramineæ*).

226. *TARACTROCERA MÆVIUS*, Fabricius.

This butterfly has never been bred.

227. *ZOGRAPHETUS OGYGIA*, Hewitson.

This species also has not been bred.

228. *HYAROTIS ADEASTUS*, Cramer.*Phanix sylvestris*, Roxb. (*Palmæe*).*Calamus pseudo-tenuis*, Becc. and Hook. f. (*Palmæe*).

EGG. The egg is dome-shaped, widest at the bottom, the base being narrowly flanged. There are about thirty-two very fine, low meridian-like ridges not extending on to the top of the egg, reaching only to two-thirds of the height of the egg from the base; the top surface is finely frosted, all the surface is semi-satiny and frosted-looking. Colour dirty very light brown. The egg is always laid on the top of a leaf near the edge, and sometimes there are five or six eggs placed in a row.

LARVA. The larva is of the type of *Baoris oceia*, Hewitson, with which it agrees in every way. The body is long and parallel-sided, flat beneath, convex over the dorsum, narrowing somewhat towards the head in segments 2 and 3; segment 12 somewhat dilated behind the spiracles; the anal segments sloping to a thin edge, which lies flat on the resting surface, and a broadly rounded extremity. Head large, broadly oval from the front view, face slightly convex, somewhat bilobed, with a narrow clypeus, the surface pitted, dull, light brown-yellow in colour, with a dark brown medial band over the vertex to the apex of the clypeus; clypeus red-brown, with a dark medial line bordered with whitish; a few short hairs about the mouth. Spiracles oval, light yellow, with a fine brown border. Surface of the body dull, the segments well marked though not constricted in any way, and with some transverse lines; a fringe of straight, fine, colourless hairs round the margin of the anal segment, but none elsewhere. Colour blue-green-white, with a dorsal, dark indigo line from segment 3 to segment 11; segment 2 yellowish; an indistinct lateral white line. Length 33 mm., breadth 4 mm.

PUPA. The pupa is also of the type of *B. oceia*. The thorax is slightly humped; the abdomen is depressed, being broader than high; the process or snout between the eyes is long and sharp, turned up very slightly at the extremity; the proboscis is free from the ends of the wings and reaches to the end of the cremaster; the cremaster is broad, thin, spatulate, and rather long, with the edges dorsally swollen. The spiracles of segment 2 are indicated by a kidney-shaped swelling with a frosted-looking surface. The other spiracles are oval, flush, and nearly white. The surface of the body is very finely corrugated, except the frontal process which is rather coarsely ringed. The thorax has a dorsal double series of small tooth-like tubercles. The pupa is bone-coloured, with a pinkish dorsal suffusion from segments 4 to 11, a subdorsal blackish band, with a spot touching it on the outside in the



middle of each segment 3 to 11; a dorsal pink line, with a black dot on the margin of each segment on this dorsal line; a dorsal, thin, black line on the cremaster, and a dorsal darkish line on the anterior process. The pupa is about the same breadth from the shoulders to segment 9, and is highest at the thorax. Length 31 mm. over all, of which the frontal process is 4 mm., and the cremaster is 3 mm., breadth 5 mm., height at segment 9 is 4 mm., height at thorax 4.75 mm.

**HABITS.** The young larva on emerging from the egg makes a small semi-tube for itself on the underside of a leaf, covering the hollow with silk and stretching bands of silk across at intervals. Having grown somewhat the larva fastens one leaf on top of another and lives between them, eating the leaf lying under the top one. When about to pupate the larva wanders, finally pupating on the underside of a leaf with or without a covering. The pupa is fixed to the leaf by the tail and by a body-band. All the sheaths, cells, houses, nests or shelters of the larva, by whatever name we choose to call them, are thickly and evenly lined with silk. The pupæ are very often found on the dry dead leaves round the base of the palms (*Phoenix sylvestris*).

229. *AMPITITIA DIOSCORIDES*, Fabricius.

*Oryza sativa*, Linn. (*Gramineæ*).

Grasses (*Gramineæ*).

This is the *Ampittia maro*, Fabricius, of the second Kanara list, p. 54, but Dr. Chr. Aurivillius has recently shewn (*Ent. Tids.*, vol. xviii, p. 150, n. 65 (1897) that *A. dioscorides* is an older name for it.

230. *ÆROMACHUS INDISTINCTUS*, Moore.

Grasses (*Gramineæ*).

231. *PADRAONA GOLA*, Moore.

Soft grasses (*Gramineæ*).

232. *BAORIS (Parnara) CONJUNCTA*, Herrich-Schäffer.

*Zea Mays*, Linn.\* (*Gramineæ*).

Coarse broad-leaved grasses (*Gramineæ*).

Mr. Bell says that this species is the *Ohapra prominens* [recte *prominens*, Moore = *Baoris (Ohapra) sinensis*, Mabille], of the first paper, p. 371, n. 82.

233. *BAORIS OCEIA*, Hewitson.

*Bambusa arundinacea*, Willd. (*Gramineæ*).

\* Given as *Zea mais* in the second Kanara paper, p. 57.

*Dendrocalamus strictus*, Nees (*Gramineæ*).

*Ochlandra stridula*, Thwaites (*Gramineæ*).

234. BAORIS (*Parnara*) KUMARA, Moore.

*Bambusa arundinacea*, Willd. (*Gramineæ*).

*Ochlandra stridula*, Thwaites (*Gramineæ*).

In the first Kanara paper (p. 370, n. 80) it is noted that this species feeds on rice, *Oryza sativa*, Linn., Natural Order *Gramineæ*, and that the figure of the larva (pl. F, fig. 4) is represented on a bamboo leaf by mistake. Mr. Bell has only bred the larva on bamboos, and doubts that it feeds on rice or on any true grasses. Messrs. Elwes and Edwards (l.c., p. 276) record *P. kumara* in South India only from the Nilgiris, in North India only from Sikkim, and from Java and Borneo. In spite of the elaborate keys given by these gentlemen to distinguish the various species of the genus, I find it extremely difficult to differentiate many of the species given as distinct from coloration and markings only. I have not studied the prehensores, which appear to be the only safe test by which they can be satisfactorily distinguished, and that test will apply to the males only. I possess no specimens of *B. kumara* from Kanara.

235. BAORIS (*Parnara*) PHILIPPINA, Herrich-Schäffer.

Bamboo (*Gramineæ*).

Recorded by Messrs. Elwes and Edwards (l.c., p. 276) from N. Canara (E. H. Aitken), but omitted from their two Kanara lists by Messrs. Davidson, Bell and Aitken. They have probably failed to identify it, placing it under *B. kumara*, Moore, to which species it is so closely allied that in spite of Messrs. Elwes and Edwards key to separate them, I am often in doubt as to which of the two species I should apportion certain specimens. *B. philippina* is said to have in the forewing a white spot in the submedian interspace touching the submedian nervure just beyond its middle, which *B. kumara* lacks. All my Kanarese specimens possess this spot. Many specimens have this spot very faint indeed, obsolescent in fact, so that one is in doubt as to which species these specimens belong.

LARVA. The larva has the head heart-shaped, but it is rather narrow at the top and slightly indented, the vertices of the lobes being rounded; the face is shiny and pitted all over, without hairs except about the mouth where there are a few; the colour is white, with a broad, black band round the head, ending at the eyes, a black line down the centre of the face, splitting into two just before the apex of the clypeus, the two parts running parallel to the sides of the

clypeus for a very short distance, when they stop, and are met by a brown line parallel to the central one commencing one-third the length of the head from the vertex, and ending where it meets the furcation of the central line; the sides of the clypeus are lined with black, and there is a black line down the centre of the clypeus; the head is not large for the body. The colour of the head varies from that described above to pure white without any markings. The body is more or less cylindrical, lying with the ventrum flat on the leaf; the neck is considerably narrower than the head; the anal segment is flattened, roughened on top by pittings, it lies flat on the surface of the leaf, and is rounded at the end; segment 12 is slightly broader than segment 11, being swollen at the sides; the larva is very little broader and higher at segment 5 than anywhere else. Spiracles small, round, yellow. The surface of the larva is smooth, not shiny; the colour is a pure, opaque, bluish-white all over, with a slight yellowish tinge on the margins of the front segments, which are finely folded. Length 42 mm.

**PUPA.** The pupa is very similar in shape to that of *Baoris conjuncta*, Herrich-Schäffer, also in mode of suspension and in colour. The "beak" (long head-process) is slightly curved downwards, with a blunt tip, and a small piece stuck on to the top at the point with a slight point directed backwards. The proboscis is free, reaching to the hinder margin of segment 9. The cremaster is long, thin, triangular, scolloped out on the top, transparent. The surface of the pupa is shiny, with minute, erect, thick hairs covering it sparsely. The spiracular marks of segment 2 are narrowly oval in shallow depressions. Spiracles linear, white; the marks on segment 2 are the same colour as the body. Colour of body very transparent darkish green, with a rather broad, double, dorsal, white line on the abdomen. Length 32 mm., breadth 6 mm., length of snout or beak alone 3 mm. The pupa is fastened by the tail and by a band round the body.

**HABITS.** The larva lives in a more or less laxly-made cylindrical cell. It pupates free on the underside of a leaf, drawing the sides together slightly at either end of the leaf.

236. *BAORIS (Parnava) PLEBEIA*, de Nicéville.

This is the only species in the genus which has in the male a tuft of long hairs towards the base of the forewing on the underside attached to the inner margin of the wing and turned under and forwards. By this character alone it is quite easy to distinguish the male. Messrs. Elwes and Edwards (l.c., p. 274) record it from Sikkim, from Java on M. Paul Mabille's authority, from Kina Balu mountain in Borneo,

and from Pulo Laut island near Borneo. In my collection are specimens from Sikkim, and from Taungoo in Upper Tenasserim of Burma. Its occurrence in Kanara is I think doubtful, and Mr. Bell tells me that he has no specimens of it in his collection. It has never been bred, though Mr. Bell says that the larva feeds on bamboo in the second paper. The insect bred was not *B plebeiu*.

237. *BAORIS (Parnara) CANARAICA*, Moore.

This species has never been bred.

238. *BAORIS (Parnara) COLACA*, Moore.

Soft, small grasses (*Gramineæ*).

239. *BAORIS (Parnara) BEVANI*, Moore.

*Oryza sativa*, Linn. (*Gramineæ*).

Recorded in the first Kanara paper, p. 370, n. 79, but omitted by Mr. Bell from the second paper. It is doubtless a wrong identification, the specimens referred to being *B. guttatus*, Bremer and Grey, n. 216 *ante*, though it may occur in Kanara, as Messrs. Elwes and Edwards (l.c., p. 283) record it from Bombay. I have no specimens of *B. bevani* from any part of South India. In Bombay Mr. Aitken says he has bred it on grass. It is doubtful if he knew the species when he wrote.

240. *BAORIS (Chapra) SINENSIS*, Mabille.

Recorded as *Chapra promnens* [recte *prominens*], Moore, in the first Kanara paper, (p. 371, n. 82), which is synonym of *B. sinensis*, the larva feeding on "Some species of Arum." The species is omitted altogether from the second paper. Mr. Bell says it is a wrong identification, and that the specimens so recorded were *Baoris (Parnara) conjuncta*, Herrich-Schäffer.

241. *BAORIS (Chapra) SUBOCHRACEA*, Moore.

*Oryza sativa*, Linn. (*Gramineæ*).

Grasses (*Gramineæ*).

Mr. Bell thinks that this species and the following are one and the same, in which I am inclined to follow him, as I have never been able to separate them satisfactorily. The form with the underside grey, typical *B. subochracea*, is never found in Kanara in the rains, and is probably a dry-season form of *B. mathias*. Messrs. Elwes and Edwards (l.c., p. 275) keep them distinct. They say that the form of the male genitalia is different in the two species.

242. BAORIS (*Chapra*) MATHIAS, Fabricius.*Oryza sativa*, Linn. (*Gramineæ*).Grasses (*Gramineæ*).

## 243. UDASPES FOLUS, Cramer.

*Curcuma Amada*, Roxb.\* (*Scitamineæ*).*Kæmpferia pandurata*, Roxb. (*Scitamineæ*).*Hedychium coronarium*, Kœnig (*Scitamineæ*).*Amomum microstephanum*, Baker (*Scitamineæ*).

## 244. NOTOCRYPTA FEISTHAMELII, Boisduval.

*Curcuma Amada*, Roxb. (*Scitamineæ*).*Hedychium coronarium*, Kœnig (*Scitamineæ*).*Amomum microstephanum*, Baker (*Scitamineæ*).

In the second Kanara paper (p. 62) the larva of this species is said to feed on "*Maranta*." That genus of plants is not kept distinct by Sir J. D. Hooker, but appears in the synonymy of several genera of the *Scitamineæ* in conjunction with various species of plants. Messrs. Davidson, Bell and Aitken give *N. restricta*, Moore, as a species distinct from *N. feisthamelii*, and describe the transformations of both. From these descriptions the larvæ would appear to differ considerably in the two species, and feed on different plants, *N. feisthamelii* on *Amomum*, and *N. restricta* on *Curcuma*. Further observations on the subject are very desirable, as Messrs. Elwes and Edwards (l.c., p. 239) unite the two. Typically the imagines are quite distinct, but intermediate examples are apparently common. Mr. Bell maintains stoutly that the two species are distinct.

## 245. SANCUS PULLIGO, Mabille.

*Amomum microstephanum*, Baker (*Scitamineæ*).

Mr. Bell says that the larvæ of *Sancus pulligo* and *Notocrypta feisthamelii*, Boisduval, can hardly be distinguished, but that the larvæ of *N. feisthamelii* and *N. restricta*, Moore, cannot be, with care, mistaken the one for the other.

*Butterflies from the Western Himalayas and Kashmir, with the food-plants of their larvæ.*

## 1. VANESSA CARDUI, Linnæus.

*Carduus* sp. (*Compositæ*).

\* In the second Kanara paper, p. 62, the food-plant of this species is said to be *Curcuma aromatica*, Salisb., which is an incorrect identification.

2. VANESSA CASCHMIRENSIS, Kollar.

*Urtica parviflora*, Roxb. (*Urticaceæ*).

3. VANESSA XANTHOMELAS, Wiener Verzeichniss.

*Salix tetrasperma*, Roxb. (*Salicinææ*).

4. THECLA SASSANIDES, Kollar.

*Indigofera atropurpurea*, Hamilt. (*Leguminosæ*).

5. HYSUDRA SELIRA, Moore.

*Indigofera atropurpurea*, Hamilt. (*Leguminosæ*).

I may note that in the descriptions of larvæ above fourteen segments are always reckoned; all fourteen are very obvious in some larvæ, the head being the first, the anal flap the fourteenth; all fourteen somites are very distinct also in some pupæ, hardly distinguishable as regards 13 and 14 in others. Segment 2/3, &c., is the margin common to segment 2 and segment 3.

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XV.—Note on the avian genus *Harpactes*, Swainson.—By LIONEL DE NICÉVILLE, *Natural History Secretary*.

In a footnote on p. 130 *ante* Colonel C. T. Bingham points out that the genus *Harpactes* of Swainson cannot be used for a genus of birds, being preoccupied. This was first pointed out by Cabanis and Heine in *Mus. Hein.*, n. iv, pt. 1, p. 154 (1863), and referred to by Mr. Charles W. Richmond in *Proc. United States National Museum*, vol. xvii, p. 602, footnote (1894); by Mr. Harry C. Oberholser in *Proc. Acad. Nat. Sciences Philadelphia*, 1899, p. 206; and in the *Ibis*, seventh series, vol. vi, p. 555 (1900). Messrs. Cabanis and Heine, Richmond, and Oberholser specify *Pyrotrogon*, Bonaparte, as the name by which these birds should be generically known, the typical species being *Trogon ardens*, Temminck.

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MASSON, W. P.—Note on four Mammals from the neighbourhood of Darjeeling. Journ. As. Soc. Bengal, LXIX, Pt. ii, 1900, pp. 89-90.

[Mammalia. Carnivora. Ursidæ.]

*Ursus malayanus* (Tree bear).

*Ursus tibetanus* (Ground bear).

Occurrence of, in the Darjeeling District.

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*Atherura macrura* (Asiatic brush-tailed porcupine).

Occurrence of, in the Darjeeling District.

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WALTON, H. J.—Note on the occurrence of *Rhodospiza obsoleta*

(Licht.) in the Tochi Valley. Journ. As. Soc. Bengal, LXIX,

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[Aves. Passeres. Fringillidæ.]

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As. Soc. Bengal, LXIX, Pt. ii, 1900, pp. 102–142.

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Journ. As. Soc. Bengal, LXIX, Pt. ii, 1900, pp. 144–146.

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FINN, F.—Notes on the structure and function of the tracheal bulb in male Anatidæ. Journ. As. Soc. Bengal, LXIX, Pt. ii, 1900, pp. 147-149.

[Aves. Anseres. Anatidæ.]

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[Hexapoda. Rhopalocera.]

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NICÉVILLE, L. DE.—Butterflies from the Western Himalayas and Kashmir, with the food-plants of their larvæ. Journ. As. Soc. Bengal, LXIX, Pt. ii 1900, pp. 214-215, 277-278.

[Hexapoda. Rhopalocera.]

Food-plants of larvæ.

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Western Himalayas and Kashmir, butterflies and larvæ, food-plants.

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N.

NICÉVILLE, L. DE.—Note on the avian genus *Harpactes*, Swainson. Journ. As. Soc. Bengal, LXIX, Pt. ii, 1900, p. 278.

[Aves. Trogones. Trogonidæ.]

*Harpactes*, Swainson—

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*Pyrotrogon*, Bonaparte—

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XVI.—*Materials for a Carcinological Fauna of India. No. 6. The Brachyura Catometopa, or Grapsoida.*—By A. ALCOCK, M.B.,  
C.M.Z.S., Superintendent of the Indian Museum.

[Received 25th June; Read 4th July.]

In treating the Catometopes I have in the main followed the scheme of Milne Edwards (*Annales des Sciences Naturelles* for 1852 and 1853) as modified by Dana, and I may introduce this paper with a statement of the points at which it deviates from the former of those classical works.

In the first place, following Dana and most subsequent authors, I have evicted the *Telphusidæ*. With them must also go *Gecarcinucus*, which is an undoubted Telphusoid, although it is persistently ranked with the *Geocarcinidæ*.

Again I have followed the lead of Dana in his treatment of the *Gonoplacæa* of Milne Edwards, the genera of which are distributed among the *Ocypodidæ* and the Sesarmine *Grapsidæ*, while *Gonoplax* itself is relegated to the *Carcinoplacidæ*.

This step necessitates a considerable enlargement of Milne Edwards' group of *Carcinoplacinae*, and a reconstruction of his *Ocypodinae*, and in carrying this out I have in the main followed Dana's admirable system.

The isolation of *Myctiris* as an independent family, which was first suggested by Dana, is here accented, but at the same time I fully agree with Milne Edwards estimate of this singular form as a "satellite" of the *Ocypodoids*.

In grouping the genera of the *Grapsidæ* I have departed very little from the arrangement of Milne Edwards, who recognized—though his successors have ignored it—the independence of the *Varuna* group.

I have adopted Dana's family of *Geocarcinidæ*, but with some hesitation, for Milne Edwards' estimation of the group as a subfamily of *Grapsidæ* has much to recommend it.

I gladly follow Milne Edwards in recognizing the *Hymenosoma* group as a *tribu principale* not distantly related to the *Ocypodes* and quite distinct from and independent of the *Pinnoteræ* group.

As regards additions to the *Catometopa* as known to and recognized by Milne Edwards, I may mention the *Rhizopinæ* (Stimpson, Miers), the *Hexapodinæ*, the *Palicidæ* (which include *Cymopolia* formerly classed with the *Dorippidæ*), and the new family *Ptenoplacidæ*.

From the system of Dana I would dissent only in separating the *Hymenosoma*-group from the *Pinnoteridæ*; in enlarging the *Scopimerinæ* (= *Dotinæ*) at the expense of the *Ocypodidæ*; in splitting the *Grapsinæ* into two equal groups,—one round *Grapsus*, the other round *Varuna*; and in removing *Gecarcinucus* from the *Geocarcinidæ*.

The scheme of classification proposed by Miers seems to me to, too often, disregard natural relations without facilitating the recognition of species by way of compensation.

The most conspicuous instance is the family *Pinnoteridæ*, in which we find *Pinnoteræ* and its kindred included with such undoubted *Ocypodoids* as *Dotilla* and *Scopimera*, with *Mictyris*, with *Hymenosoma* and its allies, and finally with *Hexapus* whose affinities are quite clearly with the *Rhizopinæ*.

Again by the exclusion of *Scopimera* and *Dotilla* and by the inclusion of the *Gonoplacidæ*, Miers' family of *Ocypodidæ* becomes unnatural and incomplete.

I follow Miers in treating the *Rhizopinæ* as a subfamily of *Carcinoplacidæ*.

Ortman obviates some difficulties by separating *Gonoplaæ* and *Ommatocarcinus* from the *Carcinoplacidæ* as a distinct family, and by altogether removing the *Hymenosomidæ* from the *Catometopes*. By the latter step his *Pinnoteridæ* gain in natural value, as they further do by the restoration of *Scopimera* and *Dotilla* to their place among the

Ocypodoids; so that both his *Pinnotheridæ* and *Ocypodidæ* are far more natural families than those of Miers. I am doubtful, however, whether Ortmann has assigned its full rank to *Mictyris*, or their proper place to the *Hexapodinæ*.

The Catometope crabs of the Indian fauna number about 140, of which 136 are noticed in the present paper. Of these, 31 are new to science, and include 2 species of *Libyates*, 1 of *Psopheticus*, 2 of *Litochira*, 1 of *Notonyx*, 1 of *Ceratoplax*, 1 of *Typhlocarcinus*, 2 of *Pinnotheres*, 3 of *Dotilla*, 2 of *Scopimera*, 1 of *Glistostoma*, 1 of *Tyloidiplax*, 1 of *Elamena*, 2 of *Hymenicus*, 2 of *Ptychognathus*, 1 of *Pyxidognathus*, 3 of *Sesarma*, 2 of *Palicus* (*Cymopolia*), and 1 of each of the following new genera, *Typhlocarcinodes* (Rhizopinæ), *Lambdophallus* (Hexapodinæ), and *Othasmocarcinops* (Asthenognathinæ).

The new species are, for the most part, either little crabs that are liable to be overlooked, or inhabitants of depths which, though moderate, are inaccessible to ordinary collectors.

As heretofore, most of the new species come from the copious collections of the "Investigator" and will be duly figured in the *Illustrations of the Zoology of the R.I.M.S. Investigator*.

#### Tribe CATOMETOPA.

*Quadrilatera*, Latreille (pt.), Fam. Nat. du Règne Anim. p. 269.

*Catometopes*, Milne Edwards (pt.), Hist. Nat. Crust. II. p. 1.

*Cancris* (pt.), *Ocypodes*, *Grapsi*, *Pinnotheridea*, De Haan, Faun. Japon. Crust.

*Ocypodidæ*, Milne Edwards (pt.), Ann. Sci. Nat., Zool., (3) XVIII. 1852, pp. 128, 140.

*Grapsoidæ*, Dana, U. S. Expl. Exp. Crust. pt. I. pp. 67, 306.

*Catometopa*, Miers, Challenger Brachyura, p. 216.

*Catometopa*, Ortmann, Zool. Jahrb., Syst. VII. 1893-94, pp. 411, 683, plus *Majoidea Hymenosomidæ*, p. 31: and in Bronn's Thier Reich, V. ii. *Arthropoda*, pp. 1165, 1168, 1175.

The carapace is variable, but commonly and typically it is transverse, more or less quadrate, with large branchial and small and indistinct hepatic regions and a broad front. The front also is variable in form, but typically it is much deflexed.

The orbits, typically, occupy the whole or the greater part of the anterior border of the carapace on either side of the front. The typical fold of the antennules is transverse; but it may be oblique, or nearly vertical, and in a few cases there are no distinct fossæ at all into which these appendages can fold.

The epistome, typically, is extremely short, but occasionally it is

of considerable length. The buccal orifice is typically, but by no means always, square cut.

The palp of the external maxillipeds usually articulates either at the summit, or at or near the external angle, of the merus; but often, as in almost the whole family *Gonoplacidae*, it articulates distinctly at the antero-internal angle.

*The genital ducts of the male usually perforate the sternum opposite the last pair of legs: if, as happens in the family Gonoplacidae, they perforate the bases of the last pair of legs, they pass forwards to their destination in a groove in the sternum.*

The abdomen of the male is very often narrow at its base and so does not cover all the space between the last pair of legs.

The branchiæ are often fewer than 9—from 8 to 6—on either side: their efferent channels open on either side of the palate.

The *Catometopa* may be divided into 9 families. One of these, the *Gonoplacidae*, so closely approaches the Cyclometope family *Xanthidae* that such Xanthoid forms as *Geryon* and *Oamptoplax* have by some authors been included in it, while, on the other hand, some of its constituent genera, such as *Gonoplax* and *Carcinoplax*, have been ranged among the Cyclometopes.

Three other families, namely, the *Grapsidae*, the *Geocarcinidae*, and the *Ocypodidae*, include the typical *Catometopes*, upon which our general conception of the group is founded.

The remaining five families are more or less aberrant, they are the *Pinnoteridae*, the *Mictyridae*, the *Hymenosomidae*, the *Palicidae*, and the *Ptenoplacidae*.

Of these aberrant families, the *Pinnoteridae* are probably most nearly related to the *Gonoplacidae*, the *Mictyridae* to the *Ocypodidae*, and the *Palicidae* to the *Grapsidae*.

The true position of the *Hymenosomidae* appears to me to be still doubtful. Many authors place them near the *Pinnoteridae* and *Mictyridae*, and I think that their most natural place is alongside the *Mictyridae*. Ortmann alone boldly removes them from the *Catometope* grade altogether and unites them with the *Oxyrhyncha*, which I think is a decided mistake.

There remains the family *Ptenoplacidae*, which includes the single species *Ptenoplax notopus*. This, though it has a superficial resemblance to *Macrophthalmus*, is remote from that genus in many important characters, and, though it has no look of *Hexapus*, yet shows an attraction to *Hexapus* and *Lambdophallus* that can hardly be accidental.

The 9 families may be characterized as follows, their compass in relation to the schemes of other authors will be noted in the sequel:—

**Family GONOPLACIDÆ.** Marine Catometopes closely resembling Cyclometopes. The palp of the external maxillipeds articulates at or near the antero-internal angle of the merus, never at the antero-external angle or at the middle of the anterior border: the exognath of the external maxillipeds is of normal size and is not concealed. The interantennular septum is a thin plate. The division of the orbit into two fossæ is not accented.

**Family GRAPSIDÆ.** Littoral (rock-haunting), or pelagic (drift-weed and timber-haunting), or estuarine and paludine, or fluviatile, or rarely terrene Catometopes. The palp of the external maxillipeds articulates either at the antero-external angle, or at the summit, or at the middle of the anterior border of the merus: the exognath is either abnormally slender or abnormally broad. The interantennular septum is very broad. The division of the orbit into two fossæ is accented. [Front of great breadth: carapace usually quadrilateral, with the lateral borders either straight or very slightly arched, and the orbits at or very near the antero-lateral angles: the buccal cavern is square and there is generally a gap, which is often large and rhomboidal, between the external maxillipeds]. Male openings sternal.

**Family GEOCARCINIDÆ.** Terrene Catometopes (Land-crabs). The palp of the external maxillipeds articulates either at the antero-external angle or at the middle of the anterior border of the merus (but is sometimes, though never in any Indian species, completely hidden behind the merus): the exognath is slender and inconspicuous (sometimes more or less concealed) and sometimes carries no flagellum. The interantennular septum is very broad and the antennular fossæ are narrow. The front is of moderate breadth and always strongly deflexed: the carapace is more or less transversely oval, *the antero-lateral borders being strongly arched and the fronto-orbital border being very much less than the greatest breadth of the carapace.* In all the Indian forms there is a wide rhomboidal gap between the external maxillipeds. Male openings sternal.

**Family OCYPODIDÆ.** Amphibious littoral and estuarine crabs, burrowing, and commonly gregarious. The palp of the external maxillipeds is coarse, and articulates at or near the antero-external angle of the merus: the exognath is generally slender and often more or less concealed. The interantennular septum is generally broad, but in one

subfamily (*Macrophthalminæ*) is a thin plate. The front is usually of no great breadth, and is often a narrow lobe more or less deflexed. The orbits occupy the whole anterior border of the carapace outside the front, and their outer wall (between the far ends of the upper and lower borders) is often defective. The buccal cavern is usually large and a little narrower in front than behind, the external maxillipeds are foliaceous and usually completely close it, but if they do not they never leave between them a wide rhomboidal space exposing the mandibles. The abdomen of the male is narrow. Male openings sternal.

Family PINNOTERIDÆ. Small crabs, usually living as commensals in the mantle-cavity of Bivalve Mollusks or Ascidians, in the cloaca of Holothurians, in worm-tubes, or in coral-stocks, and hence often exhibiting degeneration of some of the organs of special sense. The external maxillipeds vary: the merus, though often very large, is never quadrilateral, and never carries the palp distinctly at the antero-internal angle: the ischium is often small, and is sometimes absent or indistinguishably fused with the merus, in which case the merus lies with its long axis directed obliquely or almost transversely inwards: the exognath is small and more or less concealed. The interantennular septum, when distinguishable, is a thin plate. [The front is narrow, the eyes and orbits very small, the cornæ sometimes obsolescent: the antennules and antennæ are usually very small and cramped. The buccal cavern is short and of great breadth, being commonly semi-circular in outline. The male abdomen is very narrow]. Male openings sternal.

Family MICTYRIDÆ. Amphibious Catometopes resembling the *Ocypodidæ* in habits. The buccal cavern is of enormous size and is completely closed by the enormous foliaceous convex external maxillipeds, whose coarse palp articulates with the antero-external angle of the merus, and whose short slender exognath is entirely concealed and carries no flagellum. The interantennular septum is narrow. The orbits are represented by a small post-ocular spine, the eyes being quite unconcealed. [Carapace elongate-globose: front a narrow declivous lobe: the rudimentary antennular flagella fold nearly vertically, and are a good deal concealed by the front: the abdomen of the male resembles that of the female and covers the greater part of the sternum. No membranous spaces (*tympana*) on the meropodites of the legs or on the sternum]. Male openings sternal.



Family HYMENOSOMIDÆ. Small marine and estuarine Catometopes having a curious superficial resemblance to some of the Oxyrhynch crabs of the Inachine subfamily, a resemblance heightened by the fact that the epistome is sometimes nearly as long as broad. The palp of the external maxillipeds articulates near the antero-external angle of the merus, but as the antero-internal angle of the merus is sometimes truncated the true relations of the palp are often not quite clear: the exognath is slender and partly or entirely concealed. There are no orbits and the eyes are exposed and little retractile. [Carapace thin, flat, triangular or subcircular, not very well calcified, usually produced to form a horizontal rostrum. Antennular fossæ shallow and ill defined. Antennal peduncle slender. Buccal cavern square, the ischium of the external maxillipeds well developed]. Male openings sternal.

Family PALICIDÆ. Small Catometopes having a sort of *Dorippe* appearance. The Indian members of the family are found among coral- and shell-shingle, at a moderate depth, and have a kind of protective resemblance to an eroded flake of coral rock. The external maxillipeds close the buccal cavern ventrally but not anteriorly: their merus is a very small joint articulating with the retreating antero-external angle of the ischium, and carrying the palp at the middle of the oblique-lying anterior (or inner) border, their exognath is not concealed and is rather broad. The interantennular septum is a thin plate. The orbit has 2 or 3 deep gaps in the upper border. Front of moderate breadth, little or not at all deflexed: antennal flagella of good length: epistome absent: abdomen of male narrow. Compared with the other 3 pairs, the 4th (last) pair of legs, which are dorsally situated, are rudimentary in all the Indian species. Male openings sternal: female openings placed far forward on the sternal segment corresponding with the first pair of ambulatory legs (2nd peræopods).

Family PTENOPLACIDÆ. Represented by an aberrant Catometope found only in Indian Seas at a depth of 100 to 250 fathoms. The external maxillipeds are slender and subpediform, not nearly covering the buccal cavity: their palp articulates with the summit of the slender merus: their exognath is of normal size and form, and is not concealed. The interantennular septum is a thin rudimentary plate. The orbits are very incomplete below. The front is a narrow, little deflexed lobe. No distinct antennular fossæ. Antennal flagella of good length. No epistome. Abdomen of male narrow. Compared with the other 3 pairs, the last (fourth) pair of legs are rudimentary, being also placed close together dorsally: the last segment of the sternum is also rudimentary.

The male openings are in the bases of the last pair of legs but the ducts run forward in a sternal groove.

Most of these families can be further split into subfamilies, as is shown in the following scheme :—

#### Family GONOPLACIDÆ, Dana.

*Gonoplaciens*, Milne Edwards (pt.), Hist. Nat. Crust. II. 56.

*Gonoplacés Cancéroïdes* plus *Carcinoplacineæ*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, pp. 162, 164.

*Gonoplacidae*, Dana, U. S. Expl. Exp. Crust. pt. I. pp. 308, 310.

*Carcinoplacineæ* plus *Gonoplacineæ* plus *Hesapodineæ*, Miers, Challenger Brachyura, pp. 222, 237, 275.

*Carcinoplacini*, Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 683.

*Carcinoplacidae* plus *Gonoplacidae* plus *Hesapodineæ*, Ortmann in Bronn's Thier Reich, tom. cit. pp. 1175, 1176, 1177.

This family may be divided into the 5 following subfamilies :—

Subfamily I. PSEUDORHOMBILINÆ (*Carcinoplacineæ* Miers, *Carcinoplacidae* Ortmann). Carapace Xanthoid, the regions seldom well defined: front usually of good breadth and square cut, often little deflexed: eyes and orbits of normal size and form, the eyes well pigmented and the eyestalks normally movable except in certain deep-sea genera: the antennules fold transversely: antennal flagella of fair length. Epistome well defined: buccal cavern square-cut and usually completely closed by the external maxillipeds, which have a subquadrate merus. The base of the male abdomen covers the whole space between the last pair of legs. Male openings not sternal.

Subfamily II. GONOPLACINÆ (*Gonoplacineæ* Miers, *Gonoplacidae* Ortmann). The anterior border of the subquadrate carapace is entirely occupied by the square-cut front and orbits, the front being either narrow or of fair breadth, and the orbits being long narrow trenches for the elongate eyestalks. In other respects similar to the *Pseudorhombilineæ*.

Subfamily III. PRIONOPLACINÆ (not represented in India). Differs from *Pseudorhombilineæ* only in the form of the male abdomen, which is not broad enough at base to cover all the space between the last pair of legs.

Subfamily IV. RHIZOPINE (*Rhizopinæ* Miers, Ortmann). With the exception of one species (*Notonyx nitidus*) the eyestalks are fixed, and very often the "cornea" is minute or obsolete: the lower border of the orbit has a tendency to run downwards towards the epistome. The carapace usually has its antero-lateral corners cut away and rounded off: the front may be square-cut and broad, but is more often narrow and more or less distinctly bilobed and deflexed. The antennules may be of fair size and transversely folded, but more often, owing to the narrowness of the front, they are cramped, and fold obliquely: sometimes they cannot be folded in their fossæ at all. Antennal flagella usually short. The epistome may either be well defined and prominent, or ill defined and sunken. The buccal cavern may be squarish, but it often is decreased in breadth anteriorly: the external maxillipeds have a square merus and may completely close the buccal cavern, or there may be a gap between them. The male abdomen does not nearly cover the space between the last pair of ambulatory legs. Male openings sternal.

Subfamily V. HEXAPODINE (*Pinnoteridæ-Hexapodinæ* Miers, Ortmann). Only three pairs of legs besides the chelipeds, the last segment of the sternum also aborted. Carapace much broader than long with the antero-lateral corners cut away and rounded off. Front narrow: eyes, orbits and antennæ small: the antennules fold transversely. Epistome well defined: buccal cavern with the sides a little anteriorly-convergent, or not, nearly closed by the external maxillipeds, whose merus is either quadrate or has the antero-external angle rounded off. The male abdomen does not nearly fill the space between the last pair of ambulatory legs. Male openings sternal.

#### Family PINNOTERIDÆ, Edw.

*Pinnoteridæ*, De Haan (part), Faun. Japon., Crust., pp. 5, '34.

*Pinnothériens*, Milne Edwards (part), Hist. Nat. Crust. II, 28.

*Pinnotherinæ*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1853, p. 188, and XX. 1853, p. 216: Dana, U. S. Expl. Exp., Crust. pt. I. pp. 378, 379: Miers, Challenger Brachyura, p. 274: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 691; and in Bronn's Thier Reich, tom. cit. p. 1177.

I propose, with some diffidence, as I have not examined enough of the forms included, to divide this family into 4 subfamilies:—

Subfamily I. PINNOTEINÆ. Ischium of the external maxillipeds either rudimentary, or indistinguishably fused with the merus to form a single piece which is usually oblique, sometimes transverse. Usually the carapace is not transverse and the palp of the external maxillipeds not so large as the merus-ischium.

Subfamily II. PINNOTHERELINÆ. Ischium of the external maxillipeds distinct and independent, but smaller than the merus, the latter joint little oblique. Usually the carapace is broadly transverse, and often the palp of the external maxillipeds is the largest part of these appendages.

Subfamily III. XENOPHTHALMINÆ. Ischium of the external maxillipeds distinct, as large as or larger than the merus, the latter joint little oblique, the palp of ordinary size. *The orbits are narrow chinks situated dorsally with their long axis at right angles to the anterior border of the carapace.*

Subfamily IV. ASTHENOGNATHINÆ (*Asthenognathidæ* Stimpson). External maxillipeds weak and slender, not nearly meeting across the buccal cavern, the ischium distinct and larger than the merus, the palp of ordinary size. Eyes in the normal position.

#### Family GRAPSIDÆ, Dana.

*Grapsoidiens*, Milne Edwards, *Hist. Nat. Crust.* II. 68.

*Grapsinæ*, Milne Edwards, *Ann. Sci. Nat., Zool.*, (3) XVIII. p. 136 and XX. p. 163.

*Grapsidæ*, Dana, *U. S. Expl. Exp., Crust.* p. 329; Miers, *Challenger Brachyura*, p. 252; Ortmann, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 699, and in *Bronn's Thier Reich, tom. cit.* p. 1177.

This family can be divided into four well characterized subfamilies as follows:—

Subfamily I. GRAPSINÆ (*Grapsacea*, Edw., *Grapsinæ* in part, Dana, Kingsley, Miers, Ortmann). Front strongly deflexed: the lower border of the orbit runs downwards towards the buccal cavern: antennal flagellum very short: the external maxillipeds leave a wide rhomboidal gap between them, they are not traversed by any oblique hairy crest, their palp articulates at the antero-external angle of the merus, and their exognath is very slender and is exposed throughout. The male abdomen fills all the space between the last pair of ambulatory legs.

Subfamily II. VARUNINÆ (*Varunacea* and *Cyclograpsacea* part, Milne Edwards; *Grapsinæ* in part, Dana, Kingsley, Miers, Ortmann). Front moderately or little deflexed, sometimes sublaminar: the sub-orbital crest, which supplements the defective lower border of the orbit, is rather distant from the orbit and usually runs nearly in a line with the anterior border of the epistome: antennal flagellum usually of good length: the external maxillipeds do not often gape widely, though usually there is something of a gap, they are not traversed by any oblique hairy crest, their palp articulates with the middle of the

anterior border of the merus, and their exognath is generally broad and is exposed throughout. The male abdomen, though not narrow, rarely covers all the space between the last pair of ambulatory legs.

Subfamily III. SESARMINÆ. (*Sesarmacea* and *Cyclograpsacea* part, Milne Edwards; *Sesarminæ*, Dana, Kingsley, Miers, Ortmann). Front strongly deflexed: the lower border of the orbit commonly runs downwards towards the angle of the buccal cavern: the external maxillipeds leave a wide rhomboidal gap between them, an *oblique hairy crest traverses them from a point near the antero-external angle of the ischium to a point near the antero-internal angle of the merus*, their palp articulates either at the summit or near the antero-external angle of the merus, and their exognath is slender and either partly or almost entirely concealed. The male abdomen either fills or does not quite fill all the space between the last pair of ambulatory legs. Antennal flagella variable.

Subfamily IV. PLAGUSIINÆ. (*Plagusiacea*, Milne Edwards; *Plagusinæ*, Dana, Kingsley, Miers, Ortmann). The front is cut into lobes or teeth by the annular fossæ, which are visible in a dorsal view as deep clefts: the lower border of the orbit curves down into line with the prominent anterior border of the buccal cavern: the external maxillipeds do not completely close the buccal cavern but they do not leave a wide rhomboidal gap, they are not traversed by any oblique hairy crest, their palp articulates near the antero-external angle of the merus, and their slender exposed exognath has no flagellum. The antennal flagella are short. The male abdomen fills all the space between the last pair of legs.

#### Family GEOCARCINIDÆ, Dana.

*Gécarciniens*, Milne Edwards, *Hist. Nat. Crust.* II. 16.

*Gecarcinacea*, Milne Edwards (pt.), *Ann. Sci. Nat., Zool.*, (3) XX. 1853, p. 200.

*Gecarcinidæ*, Dana (pt.), *U. S. Expl. Exp. Crust.* pt. I. p. 374.

*Gecarcinidæ*, Miers, *Challenger Brachyura*, p. 216.

*Gecarcinidæ*, Ortmann (pt.), *Zool. Jahrb. Syst.* VII. 1893-94, pp. 699, 732, and in Bronn's *Thier Reich*, *tom. cit.* p. 1178.

I think it inadvisable to subdivide this small group, which Milne Edwards, with more justice, regarded as itself only a subfamily of the *Grapsidæ*.

*Gecarcinucus* is a Telphusoid and should not be referred here. *Epigrapsus* and *Grapsodes*, if they are distinct from one another, belong here rather than to the *Grapsidæ*.

## Family PALICIDÆ (vel CYMOPOLIDÆ).

This little and aberrant family is probably best treated as an appendage to the *Grapsidæ*.

## Family OCYPODIDÆ, Ortmann (pt.).

*Ocypodiens*, Milne Edwards, Hist. Nat. Crust. II. p. 39.

*Ocypodinæ*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 140, plus *Gonoplacés Vigils* (pt.), p. 155.

*Macrophthalmidæ*, Dana, U. S. Expl. Exp. Crust. pt. I. pp. 308, 312.

*Ocypodinæ*, Miers (pt.), Challenger Brachyura, p. 236, and *Myctirinæ* (pt.), p. 275.

*Ocypodidæ*, Ortmann (pt.), Zool. Jahrb., Syst., VII. 1893-94, pp. 700, 741; and in Bronn's Thier Reich, tom. cit., p. 1179.

In the treatment of this family nothing can be added to the scheme of Dana, where they are divided into 3 sub-families as follows:—

Subfamily I. OCYPODINÆ (*Ocypodiacés Ordinaires* Edw., *Ocypodinæ* Dana (pt.), Miers (pt.), Ortmann). Carapace deep, subquadrilateral, the regions seldom well defined: front narrow deflexed, commonly a mere lobe between the long eyestalks: antennular flagellum small, folding obliquely or almost vertically, the interantennular septum broad: the external maxillipeds completely close the buccal cavern, their exognath is inconspicuous but is not, or not entirely, concealed, and may either have, or be destitute of, a flagellum: chelipeds remarkably unequal either in both sexes or in the male only. *There is an orifice or recess, the edge of which is thickly fringed with hair, between the bases of the 2nd and 3rd pairs of true legs.*

Subfamily II. SCOPIMERINÆ (*Ocypodiacés Globulaires* Edw., *Dotinæ* Dana, *Myctirinæ* (pt.) Miers, Ortmann). Carapace very deep, cuboidal or globose: front narrow deflexed, commonly a mere lobe: antennular flagellum rudimentary, folding nearly vertically and hidden beneath the front, interantennular septum broad: buccal cavity large, sometimes enormous, completely closed by the external maxillipeds which are commonly very prominent and have small linear concealed exognaths with or without a flagellum: chelipeds equal or subequal in both sexes. *Orbits shallow. Curious membranous spaces known as "tympana" exist on the meropodites of the legs and often of the chelipeds also; and sometimes on some of the segments of the sternum. No hairy recesses between the bases of the 2nd and 3rd pairs of true legs.*

Subfamily III. MACROPHTHALMINÆ. (*Gonoplacés Vigils* pt. Edw., *Macrophthalminæ* Dana, Miers, Ortmann). Carapace usually quadrilateral, broader than long (sometimes more than twice as broad as long),

flattish and not very deep, the regions usually well defined: front variable, but never very broad: antennules with a well developed flagellum that folds transversely, interantennular septum very narrow: eyestalks usually elongate: the external maxillipeds do not always meet across the buccal cavern, though the gap between them is never very wide, their exognath is not, or not entirely, concealed and has a flagellum: chelipeds usually subequal. No special recess between the bases of any of the legs.

#### Family MICTYRIDÆ, Dana.

*Pinnotheriens*, Milne Edwards (pt.), Hist. Nat. Crust. II. 39.

*Myctiroidea*, Milne Edwards, Ann. Sci. Nat., Zool., (8) XVIII. 1852, p. 154.

*Mictyridæ*, Dana, U. S. Expl. Exp., Crust. pt. I, pp. 309, 389.

*Pinnotheridæ-Myctirinæ*, Miers (pt.), Challenger Brachyura, p. 275; Ortmann (pt.) in Bronn's Thier Reich, tom. cit., p. 1179.

*Ocypodidæ-Myctirinæ*, Ortmann (pt.), Zool. Jahrb., Syst. VII. 1893-94, pp. 742, 747.

There can be little question that Milne Edwards was right in reckoning *Mictyris* as a "satellite" of the *Ocypodidæ*, or that Dana's plan of separating them as a distinct family is fully justified. The affinities which several authors find between *Mictyris* and the *Pinnotheridæ* are by no means easy to recognize.

#### Family HYMENOSOMIDÆ, Ortmann.

*Pinnotheriens*, Milne Edwards (pt.), Hist. Nat. Crust. II. 39.

*Hymenosominæ*, Milne Edwards, Ann. Sci. Nat., Zool. (3) XX. 1853, p. 221.

*Pinnotheridæ-Hymenicinæ*, Dana, U. S. Expl. Exp., Crust. pt. I, pp. 379, 384.

*Pinnotheridæ-Hymenosominæ*, Miers, Challenger Brachyura, p. 275.

*Majoidea-Hymenosomidæ*, Ortmann, in Bronn's Thier Reich, tom. cit., p. 1168.

Three types seem to be distinguishable in this family: in one (e.g. *Hymenosoma*) there is no epistome and the external maxillipeds almost encroach on the bases of the antennules, which appendages are not concealed by the front; in the second (e.g. *Halicarcinus*) there is an epistome of considerable length, but the antennules are still unconcealed by the front; in the third (e.g. *Hymenicus*) there is a long epistome and the antennules are quite concealed by the front.

#### Family PTENOPLACIDÆ.

This family has no very close connexions with any of the others although it is an undoubted Catometope.

The following is a list of all the Catometope genera known to me arranged according to the foregoing scheme. As in previous papers, the genera known to me by autopsy are marked with an asterisk, and all the Indian genera are printed in roman type.

Family GONOPLACIDÆ, Dana.

Subfamily I. PSEUDORHOMBILINÆ, *nov.*

? *Brachygrapsus*, J. S. Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 203.

*Bathylpax*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII, 1880-81, p. 16: Miers, Challenger Brachyura, p. 230.

? *Camptandrium*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 106.

\* *Carcinoplax* (= *Curtonotus*).

\* *Catoptrus* (= *Goniocaphyra*).

? *Cryptocaloma*, Miers, Zool. H. M. S. Alert, p. 227.

\* *Eucrate*.

*Freyvillea*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII, 1880-81, p. 15.

*Heteroplax*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 94.

\* *Libystes*.

\* *Litochira*.

\* *Pilumnoplax*.

\* ? *Platypilumnus*.

\* *Pseudorhombila*.

\* *Psopheticus*.

Subfamily II. PRIONOPLACINÆ, *nov.*

*Eucratoplax*, A. Milne Edwards, Bull. Mus. Comp. Zool. VIII, 1880-81, p. 17.

*Eucratopsis*, Smith, Amer. Journ. Sci. XLVIII, 1869, p. 391, and Trans. Connect. Acad. II. 1871-73, p. 35.

*Euryplax*, Stimpson, Ann. Lyc. Nat. Hist., New York, VII, 1862, p. 60.

*Glyptoplax*, Smith, Trans. Connect. Acad. II, 1871-73, p. 164.

*Oediplax*, Mary J. Rathbun, P. U. S. Nat. Mus. XVI, 1893, p. 241.

*Panoplax*, Stimpson, Bull. Mus. Comp. Zool. II, 1870-71, p. 151.

*Prionoplax*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII, 1852, p. 163.

*Speocarcinus*, Stimpson, Ann. Lyc. Nat. Hist., York, VII, 1862, p. 58.



## Subfamily III. GONOPLACINÆ, Miers.

\* *Gonoplax*, Leach, Trans. Linn. Soc. XI, 1815, p. 323: Miers, Challenger Brachyura, p. 245.

*Ommatocarcinus*, White, in Voy. H. M. S. Rattlesnake, II, p. 393; Miers, Challenger Brachyura, p. 246.

## Subfamily IV. RHIZOPINÆ, Stimpson, Miers.

\* *Camatopsis*.

\* *Ceratoplax*.

? *Chasmocarcinus*, Mary J. Rathbun, Bull. Nat. Hist. Iowa, 1898, p. 284.

\* *Hephthopelta*.

\* *Notonyx*.

*Rhizopa*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 95.

\* *Scelopidia* (= *Hypophthalmus*).

\* *Typhlocarcinus*.

\* *Typhlocarcinodes*.

\* *Xenophthalmodes*.

## Subfamily V. HEXAPODINÆ, Miers.

*Amorphopus*, Bell, Journ. Linn. Soc., Zool., III, 1859, p. 27.

\* *Hexapus*, De Haan, Faun. Japon. Crust., p. 35.

\* *Lambdophallus*.

*Thaumastoplax*, Miers, Ann. Mag. Nat. Hist. (5) VIII, 1881, p. 261.

## Family PINNOTERIDÆ, Edw.

Subfamily I. PINNOTERINÆ, *nov.*

*Cryptophrys*, Mary J. Rathbun, P. U. S. Nat. Mus. XVI, 1893, p. 250.

*Dissodactylus*, S. I. Smith, Trans. Connect. Acad. II, 1871-73, p. 172.

*Durckheimia*, de Man, Zool. Jahrb., Syst., 1889, p. 442.

*Fabia*, Dana, Proc. Ac. Nat. Sci. Philad. 1851, p. 253, and U. S. Expl. Exp., Crust. pt. I. p. 382.

? *Holothuriophilus*, Nauck, Zeits. Wiss. Zool. XXXIV, 1880, pp. 24, 66.

*Ostracoteres*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX, 1853, p. 219.

? *Parapinnixa*, Holmes, Proc. Calif. Acad. IV, 1893-94, pp. 565, 587.

*Pinnaxodes*, Heller, Novara Crust., p. 67.

\* *Pinnoteris*.

? *Scleroplax*, Mary J. Rathbun, P. U. S. Nat. Mus. XVI, 1893, p. 250.

\* *Xanthasia*.

? Subfamily II. PINNOTHERELINÆ, *nov.*

? *Malacosoma*, de Man, Notes Leyden Mus. I, 1879, p. 67.

*Opisthopus*, Mary J. Rathbun, P. U. S. Nat. Mus. XVI, 1893, p. 251.

*Pinnixa*, White, Ann. Mag. Nat. Hist. XVIII. 1846, p. 177 (= *Tubicola*, Lockington, Proc. Calif. Acad. VII. 1876, p. 55).

*Pinnotherelia*, Milne Edwards and Lucas, in Voy. Amér. Mérid., Crust. p. 24 (1843).

*Pseudopinnixa*, Ortmann (*nec* Holmes), Zool. Jahrb., Syst. VII, 1894, p. 694.

\* *Tetrias*.

? *Tritodynamia*, Ortmann, Zool. Jahrb., Syst. VII, 1894, p. 692.

? Subfamily III. XENOPHTHALMINÆ, *nov.*

\* *Xenophthalmus*.

? Subfamily IV. ASTHENOGNATHINÆ, Stimpson.

*Asthenognathus*, Stimpson, Proc. Acad. Nat. Sci. Philad. 1858, p. 107.

\* *Chasmocarcinops*.

Family OCYPODIDÆ, Ortmann, *emend.*

Subfamily I. OCYPODINÆ, Dana.

*Acanthoplax*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII, 1852, p. 151.

\* *Gelasimus*.

\* *Heloecius*, Dana, Amer. Journ. Sci., (2) XII, 1851, p. 286, and U. S. Expl. Exp., Crust. pt. I. p. 319.

\* *Ocypoda*.

Subfamily II. MACROPHTHALMINÆ, Dana.

\* *Clistostoma*.

*Chænostoma*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 97.

*Euplax*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII, 1852, p. 160; Miers, Challenger Brachyura, p. 251.

*Hemiplax*, Heller, *Novara Crust.* p. 40: Miers, *Challenger Brachyura*, p. 250.

\**Macrophthalmus*.

*Paraclitostoma*, de Man, *Zool. Jahrb., Syst.*, VIII, 1895, p. 580.

\**Tylodioplax*.

#### Subfamily III. SCOPIMERINÆ.

\**Dotilla* (= *Doto*, De Haan).

*Ilyoplax*, Stimpson, *Proc. Ac. Nat. Sci. Philad.* 1858, p. 98.

\**Scopimera*.

\**Tympanomerus* (= *Dioxippe*, de Man).

#### Family MICTYRIDÆ, Dana.

\**Mictyris*.

#### Family HYMENOSOMIDÆ, Ortmann.

\**Flamene*.

?? *Flamenopsis*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX, 1873, p. 324.

\**Halicarcinus*, White, *Ann. Mag. Nat. Hist.* XVIII, 1846, p. 178: Miers, *Challenger Brachyura*, p. 280 (= *Liriopea*, Gay, *Hist. Fis. Chile*, pt. III. *Zool.* p. 158.

\**Hymenicus*

\**Hymenosoma*, Leach, Milne Edwards, *Hist. Nat. Crust.* II, 85: Miers, *Challenger Brachyura*, p. 279.

*Rhynchoplax*, Stimpson, *Proc. Ac. Nat. Sci. Philad.* 1858, p. 109.

\**Trigonoplax*.

#### Family GRAPSIDÆ, Dana.

##### Subfamily I. GRAPSINÆ, Dana (pt.).

\*??? *Epigrapsus*.

\**Geograpsus*.

\**Goniopsis*, De Haan, *Faun. Japon. Crust.*, p. 33 (pt.): Miers, *Challenger Brachyura*, p. 266.

\**Grapsus*.

\**Leptograpsus*, Milne Edwards, *Ann. Sci. Nat., Zool.*, (3) XX, 1853, p. 171: Miers, *Challenger Brachyura*, p. 257 (sub-genus of *Grapsus*).

\**Metopograpsus*.

*Orthograpsus*, Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, p. 194 (sub-genus of *Grapsus*).

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\**Pachygrapsus.*

*Perigrapsus*, Heller, Verh. zool.-bot. Ges. Wien, XII, 1862, p. 522, and Novara Crust. p. 48.

## Subfamily II. VARUNINÆ, nov.

? *Acmæopleura*, Stimpson, Proc. Ac. Nat. Sci. Philad., 1858, p. 105.

\**Brachynotus*, De Haan, Faun. Japon., Crust., p. 34, 1835: Miers, Challenger Brachyura, p. 264 (= *Heterograpsus*, Lucas, Expl. Sci. Algerie, Anim. Artic. I, p. 18, 1849: = *Hemigrapsus*, Dana, Amer. Journ. Sci. (2) XII, 1851, p. 288, and U. S. Expl. Exp., Crust., pt. I. p. 348).

\**Cyrtograpsus*, Dana, Amer. Journ. Sci. (2) XII, 1851, p. 288, and U. S. Expl. Exp., Crust., pt. I, p. 351.

\**Eriochir*, De Haan, Faun. Japon. Crust. p. 32.

*Euchirograpsus*, A. Milne Edwards, Bull. Mus. Comp. Zool., VIII, 1880-81, p. 18: and Milne Edwards and Bouvier "Hirondelle" (Monaco) Crust., Brachyures et Anomures, p. 46.

*Glyptograpsus*, S. I. Smith, Trans. Connect. Acad. II, 1871-73, p. 153.

\**Planes*, Leach, Malac. Pod. Brit., Expl. of pl. xxvii, figs. 1-3, 1815 (= *Nautilograpsus*, Milne Edwards, Hist. Nat. Crust. II, 89, 1837.)

*Platychirograpsus*, de Man, Zool. Anz. 1896, p. 292, and Mitteil. Nat. Mus. Hamburg, XIII, 1896, p. 95.

*Platygrapsus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 104: Miers, Challenger Brachyura, p. 263 (= *Platynotus*, De Haan, Faun. Japon., Crust., p. 34).

\**Pseudograpsus*, Milne Edwards, Hist. Nat. Crust. II, 81: Miers, Challenger Brachyura, p. 261 (= *Pachystomum*, Nauck, Zeits. Wiss. Zool. XXXIV, 1880, p. 67).

\**Ptychognathus* (= *Gnathograpsus*, A. M. Edw. = *Cælochirus*, Nauck).

\**Pyxidognathus.*

*Utica*, White, P. Z. S. 1847, p. 85, and Ann. Mag. Nat. Hist., XX, 1847, p. 206.

\**Varuna* (= *Trichopus*, De Haan).

## Subfamily III. SESARMINÆ, Dana.

\**Aratus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX, 1853, p. 187.

\**Chasmagnathus*, De Haan, Faun. Japon., Crust., p. 27 (= *Paragrapsus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX, 1853, p. 195).

\**Clistocœloma.*

\**Cyclograpsus*, Milne Edwards, Hist. Nat. Crust., II, 77, 1837  
(= *Gnathochasmus*, MacLeay, in Smith's Ill. Ann. S. Afr. p. 65, 1838).

\**Helice*, De Haan, Faun. Japon., Crust., p. 28: Miers, Challenger  
Brachyura, p. 268.

\**Metaplex* (= *Rhaconotus*, Gerst.).

\**Metasesarma*.

*Metopaulias*, Mary J. Rathbun, P. U. S. Nat. Mus. XIX, 1897,  
p. 144.

\**Sarmatium* (= *Metagrapsus*, Edw.).

\**Sesarma* (= *Holometopus*, Edw.).

#### Subfamily IV. PLAGUSIINÆ, Dana.

\**Liolophus* (= *Acanthopus*, De Haan).

\**Plagusia*.

#### Family GEOCARCINIDÆ, Dana.

\**Cardiosoma* (= *Discoplax*, A. M. Edw.).

\**Epigrapsus*.

\**Gecarcinus*, Leach, Trans. Linn. Soc. XI, 1815, p. 322: Miers,  
Challenger Brachyura, p. 217.

\**Pelocarcinus* (= *Gecarcoidea*, Edw., = *Hylæocarcinus*, W.-M., =  
*Limnocarcinus*, de Man).

*Uca*, Latr., Encycl. Méthod. X, p. 685: Milne Edwards, Hist. Nat.  
Crust. II, 21.

#### Family PALICIDÆ, Rathbun (name only).

\**Palicus* (= *Cymopolia*).

\**Grossotonotus*, A. Milne Edwards, Nouv. Archiv. du Mus. IX, 1873,  
p. 282, and Journ. Mus. Godeffroy, I, 1873, p. 258.

#### Family PTENOPLACIDÆ, Alcock.

\**Ptenoplax*.

#### Family I. GONOPLACIDÆ, Dana.

##### Subfamily i. PSEUDORHOMBILINÆ, Alcock.

##### Key to the Indian Genera.

I. Front with the edge cut straight and square, never curved,  
often prominent:—

1. The fronto-orbital border, though extensive, is much  
less than the greatest breadth of the carapace, so  
that the antero-lateral borders of the carapace have

- a distinctly Cancroid arch: the carapace is usually much broader than long:—
- i. Dactyli of last pair of legs styliform ..... PSEUDORHOMBILA.
  - ii. Dactyli of last pair of legs compressed and ciliated:—
    - a. Antero-external angle of merus of external maxillipeds not particularly produced:—
      - a. Carapace transversely quadrilateral, its antero-lateral borders with few teeth ..... CARCINOPLAX.
      - β. Carapace transversely elliptical, its antero-lateral borders with 5 or 6 teeth ..... CATOPTRUS.
    - b. Antero-external angle of merus of external maxillipeds strongly produced outwards: last pair of legs sometimes paddle-like..... LIBYSTES.
2. The fronto-orbital border is not so very much less than the greatest breadth of the carapace in extent, so that the antero-lateral borders of the carapace are either slightly arched or nearly straight: the carapace is broader than long but is not conspicuously transverse:—
- i. The antennal flagellum stands loosely in orbital hiatus:—
    - a. Carapace deepish, rather markedly transverse: the meri of the legs with a spine or spines on the anterior border ... PSOPHETICUS.
    - b. Carapace shallow, depressed, and flat, little broader than long:—
      - a. Legs spiny ..... PLATYPILUMNUS.
      - β. Legs unarmed..... PILUMNOPLAX.
  - ii. A process of the basal antenna-joint completely fills up and closes the orbital hiatus, entirely excluding the antennal flagellum ..... EUCRATE.
- II. Front with the edge slightly but distinctly curved, never cut straight and square; carapace and appendages in all the Indian species tomentose and hairy . . . . . LITOCHIRA.

#### EUCRATE, De Haan.

*Eucrate*, De Haan, Faun. Japon. Crust. p. 36: de Man, Journ. Linn. Soc., Zool., 1887-88, p. 88: Ortman, Zool. Jahrb., Syst. VII. 1893-94, p. 685.

*Heteroplax*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858 (1859) p. 94.

Carapace deepish, subquadrilateral, a little broader than long, smooth and with little or no distinction of regions, convex fore and aft, very slightly so from side to side.

The extent of the fronto-orbital border is not much less than the greatest breadth of the carapace, the antero-lateral borders therefore, which are toothed, are short and but slightly arched. Front square-cut and straight, well delimited from the well-defined supra-orbital angles, usually notched or grooved in the middle line, about a third the breadth of the carapace.

Upper border of orbit with two distinct sutures. The orbital hiatus is compactly filled and closed by a process of the basal antenna-joint, so that the antennal flagellum, which is of good length, lies entirely outside the hiatus. The antennules fold transversely.

Buccal cavern square, completely closed by the external maxillipeds, the flagellum of which articulates with the inner angle of the merus. Efferent branchial channels of palate well defined.

Chelipeds subequal, much more massive and shorter, or not much longer, than the legs.

Legs slender, unarmed; the propodite and dactylus of the last pair are compressed and are usually, but not always, somewhat broadened.

In both sexes all seven abdominal segments are distinct, and in the male the third segment covers the whole width of the sternum between the bases of the last pair of legs.

*Distribution*: Indo-Pacific (Indian, Australian and Japanese).

Following de Man and Ortman, I restrict the genus *Eucrate* to those species in which the orbital hiatus is completely stopped-up by a process of the basal antenna-joint.

*Key to the Indian species of the genus Eucrate.*

- I. Antero-lateral borders of the carapace cut into four teeth (including the outer orbital angle) all of which are distinct: dactylus of last pair of legs distinctly palmulate: front grooved or notched in the middle line:—
  1. Carapace nearly smooth..... *E. crenata*.
  2. Carapace with some short transverse ridges in its antero-lateral part..... *E. crenata* var. *affinis*.
- II. Antero-lateral borders cut into four teeth (including the orbital angle) of which the 2nd and 4th are hardly distinguishable: front with the median notch almost obsolete: dactylus of last pair of legs palmulate ..... *E. crenata* var. *dentata*.
- III. Antero-lateral borders cut into three teeth (including the orbital angle): dactylus of last pair of legs almost styliform ..... *E. sesdentulu*.

1. *Eucrate crenata*, De Haan.

*Cancer (Eucrate) crenatus*, De Haan, Faun. Japon. Crust. p. 51, pl. xv. fig. 1.

*Eucrate crenata*, Ortmann, Zool. Jahrb., Syst., VII. 1898-94, p. 688.

? *Pilumnoplas sulcatifrons*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858 (1859), p. 93; Tozzetti, 'Magenta' Crust. p. 102, pl. vii. fig. 2.

Carapace smooth, its length about five-sixths of its breadth. Front not quite a third the breadth of the carapace, notched and grooved in the middle line. Major diameter of orbit about half the width of the front.

Antero-lateral borders of carapace cut into 4 bluntish teeth, the middle two of which are the largest: a short ridge runs on to the dorsum of the carapace from the last tooth.

Chelipeds less than twice the length of the carapace, not much longer than the legs, especially in the female: one or two teeth at the far end of the upper border of the arm, and one at the inner angle of the wrist: hand rather short and squat, the fingers, which are stout, are a little longer than the palm: there is a characteristic patch of fur at the far end of the upper surface of the wrist.

Legs smooth, the last 3 joints more or less ciliated: in the 4th (last) pair the propodite and dactylus are broader and more compressed than in the other legs.

In the Indian Museum are 3 specimens from the Andamans and 1 from Madras (besides 3 from Hongkong).

The carapace of the largest specimen is 10 millim. long and 12 millim. broad.

2. *Eucrate crenata* var. *affinis*, Haswell.

*Eucrate affinis*, Haswell, P. L. S., N. S. Wales, VI. 1881-82, p. 547 and Cat. Austral. Crust. p. 86; de Man, Journ. Linn. Soc., Zool. XXII. 1887-88, p. 89, pl. v. fig. 5.

? *Pseudorhombila sulcatifrons*, var. *australiensis*, Miers, Zool. H. M. S. Alert, p. 242, pl. xxiv. fig. c.

Differs from typical *E. crenata*, specimens of the same sex and of approximately the same size compared, only in the following characters:—

(1) the carapace is more sculptured, for besides the short transverse ridge on the dorsum of the carapace that runs from the last tooth of either antero-lateral border, there are similar ridges running (a) from the 2nd tooth of either antero-lateral border, parallel with the orbit, and (b) parallel with the front, near the anterior limit of the gastric region; there is also a beaded ridge running parallel with either postero-lateral border:



(2) the patch of fur on the wrist may be smaller :

A single specimen from Mergui (Anderson collection) has the carapace 12 millim. long and 15 millim. broad.

In a large series of specimens these distinctions would probably fail.

### 3. *Eucrate crenata* var. *dentata*.

? *Heteroplas dentatus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, (1859), p. 94 :  
A. O. Walker, Journ. Linn. Soc. Zool. XX. 1886-1890, p. 110.

Differs from the typical *E. crenata*, only in the following particulars :—

(1) the front is entire, the median notch being inconspicuous or absent :

(2) the outer orbital angle and the third tooth of the antero-lateral border are large and acute, while the 2nd and 4th teeth are quite inconspicuous.

In the Indian Museum are two small specimens, one from Palk Strait (the other from Hongkong).

### 4. *Eucrate sexdentata*, Haswell.

*Eucrate sexdentata*, Haswell, P. L. S., N. S. Wales, VI. 1881-82, p. 548, and Cat. Austral. Crust. p. 86.

? *Pseudorhombila vestita* var. *sexdentata*, Miers, Zool. 'Alert,' p. 240, pl. xxiv. fig. B, and Challenger Brachyura, p. 229.

Differs from *E. crenata* in the following particulars :—

(1) the only ridges on the carapace are two exceeding faint ones running parallel with the postero-lateral borders :

(2) the antero-lateral borders are cut into 8 teeth, of which the last is spine-like :

(3) the median emargination of the front is much less distinct :

(4) the chelipeds are about  $1\frac{3}{4}$  times the length of the carapace and are decidedly shorter than the legs: there is only one distinct tooth near the far end of the upper border of the arm: the tooth at the inner angle of the wrist is very large and acute :

(5) the propodite and dactylus of the last pair of legs are not broader than those of the other legs.

In the Indian Museum is a single male from the Gulf of Martaban, 20 fms. The carapace is 11.5 millim. long and 13.5 millim. broad.

### CARCINOPLAX, Edw.

*Carcinoplas*, Milne Edwards, Hist. Nat. Crust. II. 60, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 164 : Ortmann, Zool. Jahrb., Syst., &c., VII. 1893-94, p. 685.

*Curtonotus*, De Haan, Faun. Japon. Crust., p. 20 (*nom. preocc.*).

The chief differences between this genus and *Eucrate* are that (1)

the carapace is very much broader, and its antero-lateral borders are much more arched, the fronto-orbital border being relatively much less extensive; (2) the supra-orbital angles are almost merged in the front, and the median notch of the front is almost obsolete; and (3) the orbital hiatus is not stopped up by any process of the basal antenna-joint.

Carapace deepish, subquadrilateral, usually much broader than long, smooth and with little or no distinction of regions, convex fore and aft, very slightly so from side to side.

The extent of the fronto-orbital border is much less than two-thirds the greatest breadth of the carapace, and the antero-lateral borders, which are toothed, are well arched. Front square-cut and straight, faintly notched or longitudinally grooved in the middle line, not very distinctly demarcated from the supra-orbital angles, from a third to a fourth, or less, the width of the carapace.

The upper border of the orbit is sinuous and may, or may not, be marked by a single faint suture line. The basal antenna joint is short and the antennal flagellum stands loosely in the open orbital hiatus. The antennules fold transversely.

Buccal cavern, palate, and external maxillipeds as in *Eucrate*.

Chelipeds subequal, much more massive and sometimes, in the adult, much longer than the legs.

Legs slender, unarmed; in the last pair the propodite and dactylus are compressed and decidedly broadened for swimming.

In both sexes all seven abdominal segments are distinct, and in the male the third segment covers the whole width of the sternum between the bases of the last pair of legs.

*Distribution* : Indo-Pacific (Indian, Japanese, Californian).

I exclude from the genus *Carcinoplax* those species, e.g., *setosa* and *integra*, which have the edge of the front turned down and arched: these it seems to me are better associated with *Litochira*.

*Key to the Indian species of the genus Carcinoplax.*

- I. The long diameter of the orbit is nearly three-fourths the width of the inter-orbital space: a spine or tooth at the outer angle of the wrist. Chelipeds in the adult male very much longer than the legs ... .. *C. longimanus*.
- II. The long diameter of the orbit is about half the width of the inter-orbital space: no spine or tooth at the outer angle of the wrist. Chelipeds rather shorter than the legs ... .. *C. longipes*.

5. *Carcinoplax longimanus*, De Haan.

*Cancer (Curtonotus) longimanus*, De Haan, Fann. Japon. Crust. p. 50, pl. vi. fig. 1.  
*Carcinoplax longimanus*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852,  
 p. 164; Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 688.

Carapace, length a little more than two-thirds its breadth, its surface (like that of the chelipeds) finely frosted: in the young the hepatic are obscurely delimited from the branchial and gastric regions and are very slightly tumescent.

Front proper about two-ninths the greatest breadth of the carapace, very faintly notched in the middle line, its free edge longitudinally grooved.

Orbits shallow, their major diameter more than two-thirds the width of the front: borders of orbit finely beaded, the upper border sinuous but entire.

Antero-lateral borders of carapace not much more than half the length of the postero-lateral, well arched, armed with 3 teeth or tubercles (including the outer orbital angle) which become much worn away in adults.

Chelipeds subequal, massive, varying in length with increase in age—from 2 or  $2\frac{1}{2}$  times the length of the carapace in females and young males to 4 times and more the length of the carapace in old males, the palm being the principal joint in which the lengthening takes place. There is a spine or tooth in the distal half of the upper surface of the arm, and one at either angle (inner and outer) of the wrist: a blunt crest, ending in a blunt tooth, traverses the inner surface of the palm.

The legs are long: the 3rd pair, which are slightly the longest, are a little more than twice the length of the carapace. The last two joints—as also the anterior border of the carpus—of all the legs are plumose.

In the Indian Museum are 2 specimens from the Gulf of Martaban and the Andaman Sea 53 and 60 fathoms, (besides a large male from Japan).

In spirit the colour is a light reddish ochre, the fingers uncoloured.

6. *Carcinoplax longipes* (Wood-Mason).

*Nectopanope longipes*, Wood-Mason, Ann. Mag. Nat. Hist., March, 1891, p. 262:  
 Alcock and Anderson, Ill. Zool. Investigator, Crust. pl. xiv. fig. 7.

*Carcinoplax longipes*, Alcock, Investigator Deep-Sea Brachyura, p. 71.

Carapace, length more than three-quarters its breadth, the regions barely indicated.

Front proper about a third the greatest breadth of the carapace, remarkably prominent, as faintly as possible notched in the middle line.

Orbits shallow, their upper border sinuous but entire, their major diameter about half the width of the front. Eyes small.

Antero-lateral borders of carapace not two-thirds the length of the postero-lateral, moderately arched, armed with two pro-curved spine-like teeth, and with a small blunt denticle just behind the ill-defined orbital angle.

Chelipeds twice the length of the carapace; the arm has a denticle beyond the middle of the upper border, and there is a strong spine—with sometimes a secondary spinule at its base—at the inner angle only of the wrist.

The legs are long and have the dactylus well plumed and the 2 preceding joints more scantily hairy: the third pair, which are slightly the longest, are nearly  $2\frac{1}{2}$  times the length of the carapace: though the terminal joints of the fourth (last) pair are compressed they are not so subfoliaceous as those of *C. longimanus*.

In the Indian Museum are 20 specimens from the Andamans 220 to 290 fathoms and off Travancore, 430 fathoms.

In the largest specimen the carapace is 14 millim. long and 17 millim. broad.

In spirit the colour is white with a faint pink tinge, the fingers blackish-brown.

#### 7. PSEUDORHOMBILA, Edw.

*Pseudorhombila*, Milne Edwards, Hist. Nat. Crust. II. 59, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 164.

The only particulars in which *Pseudorhombila* differs from *Carcinoplax* are that the regions of the carapace are better defined, that the square-cut front is more distinctly bilobed, that the supra-orbital border has two distinct sutures, and that the dactyli of the last pair of legs are styliform.

The only specimen in the Indian Museum that is perhaps referable to this genus is too small and too much damaged for description: it is from the Andamans.

#### LIBYSTES, A. M. Edw.

*Libyestes*, A. Milne Edwards, Ann. Soc. Entom. France, (4) VII. 1867, p. 285, and Nouv. Archiv. du Mus. IV. 1868, p. 84.

This genus unites *Carcinoplax* with *Catoptrus*. It chiefly differs

from *Carcinoplas* in having (1) a much shorter and broader carapace, (2) a much shorter and broader buccal cavern, with external maxillipeds that have the antero-external angle of the merus remarkably produced outwards, and (3) the 3rd to 5th abdominal terga of the male fused together. From *Catoptrus* it chiefly differs (1) in having the carapace more subquadrilateral than elliptical, and (2) in the curious *Amphitrite*-like form of the external maxillipeds.

Carapace deepish, subquadrilateral or subelliptical, vastly broader than long, with little or no distinction of regions, convex fore and aft, slightly so from side to side.

The extent of the fronto-orbital border is vastly less than the greatest breadth of the carapace, so that the antero-lateral borders, which may be toothed or entire, have a Cancroid-like curve. Front square-cut and quite straight, not well separated from the supra-orbital angles, slightly notched in the middle line, a third or less the greatest breadth of the carapace.

Orbits shallow, their upper border entire. The basal antenna-joint is short, and the antennal flagellum stands loosely in the orbital hiatus. The antennules fold transversely.

Buccal cavern square-cut, much broader than long; the efferent branchial canals of the palate very well defined. The merus of the external maxillipeds is short and broad and has the external angle much produced, as in many species of *Neptunus*.

Chelipeds subequal, much more massive and longer than the legs; the hands however, which are somewhat tumid, are unequal in the adult.

Legs slender, unarmed: in the Indian species the last pair are almost as paddle-like as those of the typical swimming-crabs of the Portunid family.

In the male the abdomen covers the whole width of the sternum between the last pair of legs, and the 3rd-5th abdominal terga are fused together.

The sternal canals of the male are more perfect than in any other Gonaplocoid known to me.

#### *Key to the Indian species of Libystes.*

- I. Antero-lateral borders of the carapace serrated almost exactly like those of *Catoptrus nitidus* ... .. *L. Edwardsi*.
- II. Antero-lateral borders of the carapace entire ... .. *L. Alphonsi*.

*Distribution* : Indo-Pacific (Madagascar to Sandwich Is.).

8. *Libystes Edwardsi*, n. sp.

Carapace, length about four-sevenths of the breadth, finely pitted under lens, somewhat granular near the antero-lateral borders: an angular eminence near either posterior angle and a slight concavity of the postero-lateral part of the lateral epibranchial regions give the carapace a somewhat quadrilateral cast.

Front a good deal less than a third the breadth of the carapace, perfectly straight, faintly notched in the middle line. Eyes small.

Antero-lateral borders of the carapace with 5 or 6 granular denticles followed by a sharp procurved spine.

The chelipeds have the hands unequal in the adult. They are more than three times the length of the carapace and are smooth and unarmed. The fingers are slender and hooked at tip, especially in the smaller hand: they are a good deal longer than the palm in the smaller hand, and about as long as the palm in the larger hand. On the immobile finger of the smaller hand there are several irregular enlarged teeth. [In the young, as in *Catoptrus*, the hands are nearly equal, and the fingers of both hands are equally long and slender].

The legs are slender and the longest pair are not much more than twice the length of the carapace. The last 3 joints of the last pair form typical swimming paddles.

An apparently adult specimen from the Persiau Gulf and 3 young from the Andamans are in the Indian Museum.

The carapace of the large specimen is 8 millim. long and 14 millim. broad.

9. *Libystes Alphonsi*, n. sp.

Differs from *L. Edwardsi* in the following particulars:—

(1) the carapace, though of the same proportions, is more quadrilateral and more convex fore and aft, and the eminences at the posterior angles are wanting:

(2) the antero-lateral borders of the carapace are smooth and entire:

(3) the front is more deflexed and more distinctly divided in the middle line:

(4) the chelipeds (in the young) are about  $2\frac{1}{2}$  times the length of the carapace and are nearly equal and similar: the fingers are hardly as long as the palm:

(5) The last 3 joints of the last pair of legs are much broadened and compressed, but are not such unmistakable paddles as those of *L. Edwardsi*.

In the Indian Museum is a single specimen from the Andamans : its carapace is 4 millim. long and 7 millim. broad.

This species differs but little, except in the sub-quadrilateral shape of the thorax, from the *Libystes nitidus* described and figured by M. A. Milne-Edwards.

#### CATOPTRUS, A. M. Edw.

*Catoptrus*, A. Milne Edwards, Ann. Sci. Nat. Zool. (5) XIII. 1870, p. 82; Ortmann, Zool. Jahrb., Syst. VII. 1893-94, p. 685.

*Goniocaplyra*, de Man, Archiv fur Naturges. LIII. 1887, i. p. 399.

Carapace transversely elongate-elliptical, without distinction of regions, moderately convex in both directions.

The extent of the fronto-orbital border is vastly less than the greatest breadth of the carapace, the antero-lateral borders, which are serrated, are therefore well curved. Front straight, slightly notched in the middle line, not distinctly separated from the supra-orbital angles, less than a third the greatest breadth of the carapace.

Orbits shallow, their upper border entire. The antennal flagellum, which is of good length, stands in the orbital hiatus. The antennules fold transversely.

Buccal cavern, palate, and external maxillipeds as in *Eucrate*.

Chelipeds much as in *Libystes*. Legs as in *Libystes*, except that the last pair, though they have the dactylus compressed and ciliated, are never paddle-like.

Abdomen as in *Libystes*.

*Distribution* : Indo-Pacific (Mauritius to Samoa).

*Catoptrus* really differs from *Libystes* only in the form of the merus of the external maxillipeds and of the last pair of legs, which are not paddle-like as they are in one species of *Libystes*.

#### 10. *Catoptrus nitidus*, A. M. Edw.

*Catoptrus nitidus*, A. Milne Edwards, Ann. Sci. Nat., Zool., (5) XIII. 1870, p. 82; de Man, Notes Leyden Mus. XII. 1890, p. 67; Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 687.

*Goniocaplyra truncatifrons*, de Man, Archiv fur Nat. LIII. 1887, p. 399, pl. xiv. fig. 1, and Notes Leyden Mus. XII. 1890, p. 67.

*Goniocaplyra* sp., Zehntner, Rev. Suisse Zool. II. 1894, p. 163, pl. viii. fig. 12, 12a.

Carapace, length less than two-thirds its breadth, perfectly smooth and shining except for some fine granulation near the antero-lateral borders.

Front about a third the greatest breadth of the carapace, faintly notched and grooved in the middle line.

Antero-lateral borders cut into five teeth followed by a procurved spine.

Merus of external maxillipeds having the external angle very slightly produced.

Chelipeds unequal, much longer and more massive than the legs, the larger one about three times the length of the carapace: they are smooth and unarmed, except that the anterior border of the arm is finely serrulate and that one of the serrations at either the near or far end (rarely at both) is enlarged to form a spine. In the smaller cheliped the fingers are slender hooked and finely toothed, and are rather longer than the slightly swollen palm: in the larger cheliped they are stouter and more coarsely toothed and are shorter than the swollen palm.

Legs slender, the longest pair are hardly more than twice the length of the carapace; the dactylus of all, though compressed, is slender.

In the Indian Museum are 16 specimens from off Ceylon 34 fathoms (besides 3 from Mauritius and 2 from Samoa).

In the largest specimen (from Mauritius) the carapace is 9.5 millim. long and 14.5 millim. broad. The Indian specimens, though they include egg-laden females, are much smaller.

#### PSOPHETICUS, Wood-Mason.

*Psopheticus*, Wood-Mason, Admin. Rep. Marine Survey of India, 1890-91, p. 20 (name only): Alcock, Investigator Deep-Sea Brachyura, p. 72.

*Psopheticus* in several respects connects *Carcinoplax* and *Pseudorhombila* with *Eucrate*, and hence serves to emphasize the opinion of Miers as to the closeness of the ties that connect the three latter genera.

As in *Pseudorhombila* and *Carcinoplax*, the carapace is much broader than long and the orbital hiatus is open. As in *Pseudorhombila*, the dactylus of the last pair of legs is styliform. As in *Eucrate*, the fronto-orbital border occupies almost all the breadth of the carapace.

Carapace deepish, quadrilateral or subquadrilateral, a good deal broader than long, with the regions hardly defined, moderately convex fore and aft, flat from side to side.

Fronto-orbital border little, if at all, less than the greatest breadth of the carapace, the antero-lateral borders of the carapace therefore—which are short—are either very slightly arched or are in the same



straight line with the postero-lateral borders. Front square-cut, straight, prominent, entire, not well delimited from the supra-orbital angles, a third the breadth of the carapace, or a little less.

Upper border of orbit very sinuous and with a single faint short suture line. The antennal flagellum, which is of good length, stands loosely in the orbital hiatus. The antennules fold transversely.

Mouth and external maxillipeds as in *Eucrate*.

Chelipeds much stouter than the legs. The legs end in a slender styliform dactylus, and have one or many spines on the anterior border of the merus.

In both sexes the abdomen consists of seven separate segments, and in the male the third segment covers the whole width of the sternum between the last pair of legs.

*Distribution*: Andaman Sea.

#### *Key to the (Indian) species of Psopheticus.*

- I. Carapace quite quadrilateral, the fronto-orbital border being equal to the greatest breadth of the carapace: meropodites of legs with numerous spines ... .. *P. stridulans.*
- II. Carapace subquadrilateral, the fronto-orbital border being about three-fourths its greatest breadth: meropodites of legs with a single spine ... .. *P. insignis.*

#### 11. *Psopheticus stridulans*, Wood-Mason.

*Psopheticus stridulans*, Wood-Mason, Illustrations of the Zoology of the Investigator, Crustacea, pl. v, fig. 1. (1892): Alcock, Ann. Mag. Nat. Hist., May 1894, p. 402; and Investigator Deep-Sea Brachyura, p. 78.

Carapace quite quadrilateral, three-fourths as long as broad, smooth and polished, crossed transversely in its posterior half by a broad groove which is continued obliquely across the pterygostomian regions to the angles of the mouth.

Owing to the large size of the eye and orbit, the extent of the fronto-orbital border is equal to the greatest breadth of the carapace.

A thin sharp prominent tooth at the outer orbital angle, and an obliquely-prominent spine at the junction of the antero-lateral and postero-lateral borders.

The subocular and subhepatic regions are inflated, and together form a granular eminence against which a strong spine on the upper border of the arm can be brought to play, producing a sound. Hence the names *Psopheticus* and *stridulans*.

The major diameter of the reniform eye is between a sixth and a seventh the breadth of the carapace; though the orbit does not conceal the eye its edges are well and cleanly cut.

The chelipeds in the adult male are a little more, in the adult female a little less, than twice the length of the carapace, but are slightly shorter than the legs: they are smooth and polished, as also are the legs. The arm has a strong upstanding claw-like tooth near the middle of its upper border, one or two spinules near the far end of the outer border, and a spinule near the far end of the inner border: the wrist has both the inner and the outer angles spiniform.

The third pair of legs, which are slightly the longest of the four, are rather more than two-and-a-half times the length of the carapace. In all, the anterior edge of the meropodites is armed with spines and the same edge of the carpopodites with spinules—these being least numerous and least distinct in the case of the first pair.

Colours in glycerine: chelipeds and legs rather dusky red; carapace dusky red behind the transverse groove—which forms a very sharply-defined red band—livid red, or almost violet, in front of it; eyestalks almost purple, eyes purplish-black. Eggs in life magenta.

The carapace of the largest male is 15 millim. long and 20 millim. broad.

Only known, so far, from the Andaman Sea: 2 males and a female from 173 fms., 2 males and a female (Types of the species and genus) from 188–220 fms., 7 females (3 with eggs) from 185 fms., a male and 4 females from 370–419 fms.

## 12. *Psophticus insignis*, n. sp.

Carapace subquadrilateral, the antero-lateral borders being slightly arched, about three-fourths as long as broad, smooth, crossed transversely by two very low and indistinct ridges—one (convex forwards) between the lateral epibranchial spines, the other at the level of the post-cardiac region. The extent of the fronto-orbital border is about three-fourths the greatest breadth of the carapace.

There is a bluntish tooth at the outer orbital angle, and an obliquely prominent spine at the junction of the antero-lateral and postero-lateral borders, the edge of the carapace between the two being granular.

Eye small, subglobular, its diameter being hardly a tenth the greatest breadth of the carapace.

Chelipeds more than  $2\frac{1}{2}$  times as long as the carapace and decidedly longer than the legs: they are unarmed except for a small tooth or spinule at the outer angle of the wrist.

The meropodites of the legs have the anterior border sharply granular, and in the case of the last three pair of legs there is a spine near the far end of this border. The longest pair of legs are hardly  $2\frac{1}{2}$  times as long as the carapace.

Two specimens, from the Gulf of Martaban, 60 and 67 fms.

The carapace of the largest is 13 millim. long and 19 millim. broad.

Colours in glycerine, reddish : in the middle of the carapace is a large deep-red shield with a milk-white edge and centre.

This species closely connects *Psoptheticus* with *Carcinoplax*.

#### PILUMNOPLAX, Stimpson restr.

*Pilumnoplax*, Stimpson, Proc. Ac Nat. Sci. Philad. 1858 (1859) p. 93 : Miers, Challenger Brachyura, p. 225 : Alcock, Investigator Deep Sea Brachyura, p. 74.

Carapace depressed, flat, a little broader than long, the regions very faintly indicated. Fronto-orbital border two-thirds, or more, the greatest breadth of the carapace : the antero-lateral borders, which are toothed, are slightly arched or oblique. Front square-cut, straight, rather prominent, more or less confluent with the supra-orbital angles, often notched or grooved in the middle line.

Supra-orbital border often with two fissures. The antennal flagellum, which is of good length, stands in the orbital hiatus. The antennules fold transversely, or nearly so.

Mouth and mouth-parts as in *Eucrate*.

Chelipeds either subequal or unequal, much more massive than the legs. Legs slender, their dactyli compressed.

The abdomen in both sexes is seven-jointed : in the male the 3rd segment covers the whole width of the sternum between the last pair of legs.

*Distribution* : Tropical and S. Atlantic (deep sea), Arabian Sea (deep), Japan, Fiji.

The species of *Pilumnoplax* are characterized by the flat, depressed carapace, which is also comparatively narrow and, owing to the prominence of the perfectly straight front, is subhexagonal in shape.

#### 13. *Pilumnoplax americana*, Rathbun.

*Pilumnoplax americanus*, Mary J. Rathbun, Bull. Lab. Nat. Hist. Iowa, 1898, p. 283, pl. vii figs. 1, 2.

*Pilumnoplax Sinclairei*, Alcock, Investigator Deep Sea Brachyura, p. 74, pl. iii. fig. 1.

Carapace subquadrilateral, much depressed, a little more than three-quarters as broad as long, very finely frosted, perfectly bare, the regions fairly indicated.

Front horizontal, slightly prominent, square cut, grooved but not distinctly notched in the middle, more than a third the greatest breadth

of the carapace; its free edge is turned vertically downwards and rather deeply grooved from side to side.

The antero-lateral borders are not much more than half the length of the postero-lateral: they are thin and sharp, and are cut into three teeth, of which the first is broad and bicuspid and the other two are acute. On the postero-lateral borders, just behind the junction with the antero-lateral, is a denticle.

The eyes are small but well-formed, and are freely movable. The orbits conceal the retracted eyes to dorsal view: their upper margin is fissured near the middle, and the lower margin is slightly excavated just below the outer angle: the inner angle of the lower margin is not prominent, though dentiform.

The chelipeds in both sexes are very unequal, the larger one being not quite twice as long as the carapace; their surface, under the lens, is finely frosted: the inner angle of the wrist is strongly pronounced and is capped by a pair of acute teeth.

Legs moderately stout, unarmed, smooth, almost hairless: the third pair, which are somewhat the longest, are about two-and-a-half-times the length of the carapace. The dactyli are compressed-styliform.

Colours in spirit french-grey, fingers much darker grey.

A single female specimen, from off the Travancore coast 430 fms., has the carapace 13 millim. long and 16 millim. broad.

This species is closely related to *Pilumnoplax heterochir* (Studer) Miers, but is distinguished from it by the entire and more prominent front, by the absence of transverse markings on the carapace, by the longer legs, and by the smoothness of the chelipeds and legs.

From *Pilumnoplax abyssicola* Miers, which it also closely resembles, it is distinguished by the smooth carapace (to the naked eye), by the turned-down milled edge of the front, by the spinule on the postero-lateral border, by the fissured upper-margin of the orbit, and by the double spine at the inner angle of the wrist.

*Distribution*: Off Atlantic coasts of North America (Florida and Georgia) 440 and 70 to about 200 fms. Off Travancore coast 430 fms.

A single specimen from the latter locality is in the Indian Museum collection.

#### [PLATYPILUMNUS, Wood-Mason.

*Platypilumnus*, Wood-Mason MS., Alcock, Ann. Mag. Nat. Hist., May, 1894, p. 401: Journ. Asiatic Soc. Bengal, Vol. LXVII. pt. 2, 1898, p. 232: Investigator Deep Sea Brachyura, p. 62.

This genus, like so many of the preceding, has strong affinities with

the *Xanthidæ*: it may prove to belong to that family, where I have already, with reserve, placed it.

I may here, however, state that it closely resembles *Pilumnoplax*, having a flat, depressed, slightly transverse carapace. It differs from *Pilumnoplax* in the following particulars:—

(1) the front is more prominent, so that the carapace is more decidedly hexagonal:

(2) the fronto-orbital border is sharply serrated and the chelipeds and legs are profusely spiny:

(3) the external maxillipeds do not completely close the buccal cavern, but leave a wide gap between their anterior margin and the edge of the epistome:

(4) the dactyli of the legs are styliform.

*Distribution*: Andaman Sea.]

[*Platypilumnus gracilipes*, Wood-Mason.]

*Platypilumnus gracilipes*, Wood-Mason MS., Alcock, Ann. Mag. Nat. Hist., May, 1894, p. 401: Ill. Zool. Investigator, Crust., pl. xiv. fig. 6: J.A.S.B. Vol. LXVII, pt. 2, 1898, p. 232: Investigator Deep Sea Brachyura, p. 63.

A description of the female (which is the only sex known) has been already given in this *Journal* (*loc. cit.*).

LITochira, Kinahan.

*Litochira*, Kinahan, Journ. Roy. Soc. Dublin, I. 1858, p. 121: Miers, Challenger Brachyura, p. 281.

? *Brachygrapsus*, Kingsley, Proc. Ac. Nat. Sci. Philad. 1880 (1881) p. 203.

Carapace and appendages in all the Indian species thickly tomentose and hairy.

Carapace deepish, either subquadrilateral and a good deal broader than long, or almost square, smooth, with little or no distinction of regions, flat, but declivous anteriorly. Fronto-orbital border not much less than, if not equal to, the greatest breadth of the carapace: antero-lateral borders short and if arched at all, very slightly so, and usually, but not always, with 2 or 3 teeth or spines.

Front not well delimited from the supra-orbital angles, its free edge deflexed and somewhat arched, never square-cut and laminar; more or less distinctly bilobed.

Upper border of orbit entire. The antennal flagellum, which is of good length, stands in the orbital hiatus. The antennules fold transversely, or nearly so.

Mouth and external maxillipeds as in *Eucrate*, &c.

Chelipeds subequal, more massive and usually shorter than the legs. The legs, including the dactyli, are compressed.

The abdomen of the male occupies the whole width of the sternum between the last pair of legs: in both sexes it consists of 7 segments.

I restrict the genus *Litochira* to those species which have the edge of the front turned down and distinctly arched as is shown in Kinahan's figure. These species fall into two groups, in one of which the carapace is a good deal broader than long, as in Kinahan's type, while in the other it is nearly square. Perhaps these two groups should be separated, though I do not recommend this course.

*Distribution*: S. Atlantic and Indo-Pacific (Cape to Australia).

*Key to the Indian species of Litochira.*

- I. Length of carapace about two-thirds the greatest breadth of the carapace and equal to the extent of the fronto-orbital border; the antero-lateral borders distinctly arched:—
  1. Antero-lateral borders of the carapace with three truncated teeth, exclusive of the orbital angle .. *L. angustifrons.*
  2. Antero-lateral borders with two distinct, though blunt, teeth ..... *L. setosa.*
  3. Antero-lateral borders with hardly any trace of lobulation—almost entire ... *L. integra.*
- II. Carapace more nearly square, the fronto-orbital border almost equal to its greatest breadth, so that the antero-lateral borders are almost in the same straight line with the postero-lateral borders or a very little curved:—
  1. Antero-lateral borders with two spines and one at the orbital angle: legs unarmed ..... *L. Beaumontii.*
  2. Antero-lateral borders with two spines: no spine at the orbital angle: meropodites of the legs with some spines ..... *L. quadrispinosa.*

14. *Litochira integra* (Miers).

*Carcinoplas integra*, Miers, Zool. H. M. S. Alert, p. 513, pl. xlviii, fig. C: de Man, Journ. Linn. Soc., Zool., XXII, 1887-88, p. 93.

Length of the carapace about two-thirds its breadth and equal to the extent of the fronto-orbital border.

Antero-lateral borders arched, without spines, though when completely denuded they are granular and show faint but quite distinguishable traces of division into two lobules besides the orbital angle.

Chelipeds less than twice the length of the carapace and shorter than the legs, unarmed except for an indistinct blunt tooth near the

far end of the upper border of the arm: inner angle of wrist dentiform.  
Legs unarmed.

A single female from Mergui: its carapace is 6 millim. long and 9 millim. broad.

15. *Litochira setosa* (A. M. Edw.).

*Carcinoplas setosa*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 267, pl. xii. fig. 2: de Man, Archiv f. Naturges. LIII. 1887, i. p. 349, and Journ. Linn. Soc., Zool., XXII. 1887-88, p. 98.

The only essential difference between this species and the preceding is that the carapace here is a little more depressed and that the antero-lateral borders are cut into 2 blunt teeth besides the blunt orbital angle. The size is about the same.

In the Indian Museum are 16 specimens, from the Andamans and Mergui.

16. *Litochira angustifrons*, n. sp.

Carapace, length a little more than two-thirds the breadth. Fronto-orbital border nearly five-ninths the breadth of the carapace in extent. Antero-lateral borders arched, cut into 4 teeth (including the outer orbital angle) the edges and dorsal surface of which are granular: the first 3 teeth are sharply truncated, the fourth is subacute.

Chelipeds, in the adult male, nearly twice the length of the carapace and hardly shorter than the legs; in the female much less than twice the length of the carapace and markedly shorter than the legs. There is a labule near the far end of the upper border of the arm, and the inner angle of the wrist is subacute.

Two specimens, from Bombay and Karachi. The carapace of the larger is 13 millim. long and 18 millim. broad.

This species appears to be closely related to *Filumnoplax ciliatus* Stimpson.

17. *Litochira Beaumontii*, n. sp.

Carapace, length more than two-thirds the greatest breadth, nearly square. The extent of the fronto-orbital border is hardly less than the breadth of the carapace. The antero-lateral borders are hardly arched and are armed with 8 sharp spinules—including one at the outer orbital angle.

The chelipeds are much shorter than the legs and, like them, are unarmed, except that the inner angle of the wrist is dentiform. The longest (penultimate) pair of legs are more than  $2\frac{1}{2}$  times as long as the carapace.

In the Indian Museum are 4 specimens, from the Andamans and from off Ceylon 34 fms. The carapace of the type specimen is 5 millim. long and 7 millim. broad.

Colour in spirit, uniform yellow.

18. *Litochira quadrispinosa*, Zehntner.

*Litochira quadrispinosa*, Zehntner, Rev. Suisse de Zool. II. 1894, p. 171, pl. viii. figs. 11, 11b.

Differs from *L. Beaumontii* in the following particulars only:—

- (1) the carapace is still more nearly square :
- (2) there are 2 spines on the antero-lateral borders but none at the outer orbital angles :
- (3) the inner border of the ischium and arm of the chelipeds is serrated, and the meropodites of the legs are armed with spines.
- (4) the colouration is yellow, with a large purplish-brown horse-shoe behind the front, and with sinuous markings of the same colour on the lateral subfrontal and suborbital regions of the carapace: the greater part of the antennal flagella is of the same purplish-brown colour.

In the Indian Museum is a single specimen from the Andamans: the carapace is 4 millim. long and 5 millim. broad.

Subfamily ii. GONOPLACINÆ.

19. GONOPLAX, Leach.

*Gonoplax*, Leach, Trans. Linn. Soc. XI. 1815, pp. 309, 322, and Malac. Pod. Brit. : Desmarest, Consid. Gen. Crust. p. 124, and Dict. Sci. Nat. XXVIII. p. 243 : De Haan, Faun. Japon. Crust., p. 19 : Milne Edwards, Hist. Nat. Crust. II. 60, and Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 162 : Dana, U. S. Expl. Exp. Crust. pt. I. p. 310 : Bell, Brit. Stalk-eyed Crust. p. 129 : Heller, Crust. Sudl. Europ. p. 102 : Miers, Challenger Brachyura, p. 245.

*Rhombilia*, Lamarck (part), Hist. Nat. Anim. sans Vert. (2) V. p. 466 : Latreille, Encyc. Méthod. X. p. 292.

Carapace subquadrilateral, with the antero-lateral angles acute and the lateral borders posteriorly convergent, a good deal broader than long, moderately convex, the regions but faintly indicated.

The front and orbits occupy the whole anterior border of the carapace: the front is square cut, laminar, and obliquely deflexed, and takes up between a third and a fourth of the anterior border of the carapace, the rest being taken up by the trench-like orbits.

Eyestalks long and slender: the antennules fold quite transversely beneath the front: the antennæ have a short basal joint and a slender flagellum of good length, standing in the orbital hiatus.



The buccal cavern is square and is well separated from the prominent epistome: the efferent branchial channels are not well defined. The external maxillipeds completely close the buccal cavern: their merus is square and carries the flagellum at the antero-internal angle.

Chelipeds in both sexes much more massive, and in the male very much longer, than the legs, which are long and slender.

The abdomen in both sexes consists of 7 separate segments: in the male the 3rd segment nearly but not quite covers the sternum between the last pair of legs.

*Distribution*: North-Eastern Atlantic coasts, Mediterranean basin; Persian Gulf; East Indian Archipelago.

In the Indian Museum there is a young female, lately received by myself from the Persian Gulf, of a species of *Gonoplax*. Apart from the shortness of the chelipeds it differs from *G. angulata*, of which we have several good specimens from Europe, only in wanting the terminal spine to the upper border of the meropodites of the legs.

### Subfamilies iii. & iv. RHIZOPINÆ & HEXAPODINÆ.

#### *Key to the Indian Genera.*

A. Four pairs of legs, besides the chelipeds (*Rhizopinæ*):—

I. The antennular flagella can be completely retracted within the antennular fossæ:—

1. The epistome is of good length fore and aft, it is not in any way confused with the palate but is commonly prominent and almost vertical:—

i. Eyes well formed, rarely deficient in pigment:—

a. Eyes in all respects perfect: front straight, entire, from two-fifths to half the greatest breadth of the carapace: merus of the external maxillipeds nearly square.....

NOTONYX.

b. Eyes either quite perfect or deficient in pigment: front slightly curved and notched in the middle, about a third the greatest breadth of the carapace: antero-external angle of the merus of the external maxillipeds much produced...

CERATOPLAX.

ii. Eyes obsolete or nearly so:—

a. Carapace much broader than long, the postero-lateral borders parallel ...

TYPHELOCARCINUS.

b. Carapace a little broader than long, the postero-lateral borders anteriorly-convergent .....

XENOPHTHALMODIFA.

2. The epistome is short, sunken, and not boldly separated from the palata :—
- i. Eyes minute, orbits concealed beneath the anterior border of the carapace: merus of external maxillipeds with a sharp antero-external angle ..... SCALOPIDIA.
  - ii. Eyes obsolete or nearly so, orbits visible from above: antero-external angle of merus of external maxillipeds rounded off ..... TYPHLOCARCINODUS.
- II. The basal joint of the antennules completely fills its fossa, into which the flagellum cannot therefore be retracted :—
1. Eyes small, but perfect: outer border of merus of external maxillipeds almost straight ..... HRYPHOPHELTA.
  2. Eyes reduced to a speck of pigment: outer border of merus of external maxillipeds with a strongly convex bulge outwards ..... CAMATOPSIS.
- B. Only three pairs of legs besides the chelipeds, the last pair of other crabs not being represented even by a rudiment. The *vasa efferentia* of the male open on the 4th sternal segment (*Hexapodius*) ..... LAMBOPHALLUS.

### Subfamily iii. RHIZOPINÆ, Stimps.

NOTONYX, A. M. Edw.

*Notonyx*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 268: Miers, *Challenger Brachyura*, p. 235.

Carapace deepish, subquadrilateral with the antero-lateral angles rounded off, broader than long, perfectly nude smooth and polished, without any indication of regions, convex fore and aft and anteriorly declivous.

Fronto-orbital border a good deal more than three-fourths the greatest breadth of the carapace: antero-lateral borders short, entire, curved. Front straight, sublaminar, from two-fifths to half the breadth of the carapace.

Eyes small but well developed, the eyestalks movable, obpiriform: orbits in the usual marginal position. The antennules fold transversely in well formed pits. Basal antenna-joint short; the flagellum, which is of fair length, stands in the orbital hiatus.

Epistome well formed, nearly vertical: buccal cavern a little wider in front than behind. A slight hiatus between the external maxillipeds, the merus of which appendages is square and carries the flagellum at the antero-internal angle.

Chelipeds subequal, or a little unequal, smooth and polished, much

more massive and but little shorter than the legs: palm short and rather deep, with the lower border sharply carinate.

Legs smooth, unarmed, with a very few scattered lank hairs: dactyli styliform.

The abdomen in both sexes consists of 7 separate segments and does not nearly conceal the sternum between the last pair of legs.

*Distribution*: Indo-Pacific, from Fiji to the Persian Gulf.

*Key to the Indian species of Notonyx.*

- I. Carapace, length about three-fourths the breadth: merns of external maxillipeds about as long as the ischium ... *N. nitidus*.
- II. Carapace, length about five-sixths the breadth: merns of external maxillipeds much shorter than the ischium ... *N. vitreus*.

20. *Notonyx nitidus*, A. M. Edw.

*Notonyx nitidus*, A. Milne Edwards, Nouv. Archiv. du Mus. IX, 1873, p. 269, pl. xii. fig. 3: Miers, Challenger Brachyura, p. 236.

Carapace, length a little more than three-fourths the greatest breadth. Front between a third and two-fifths the breadth of the carapace. Orbits elongate. Merus of the external maxillipeds as long as the ischium.

A small denticle near the far end of the upper border of the arm: inner angle of wrist pronounced, but not acute.

Legs with some scattered hairs along the edges, the 3rd pair, which are slightly the longest, are about  $2\frac{1}{2}$  times the length of the carapace and nearly half again as long as the chelipeds.

In the Indian Museum is a single specimen from the Persian Gulf: its carapace is 8.5 millim. long and 11 millim. broad.

21. *Notonyx vitreus*, n. sp.

Carapace, length about five-sixths the greatest breadth, rather tumid. Front nearly half the breadth of the carapace. Merus of the external maxillipeds shorter than the ischium.

No denticle on the arm: inner angle of wrist blunt. Legs with hardly any hairs, otherwise resembling those of *N. nitidus*.

In the Indian Museum is a single specimen from the Andaman Sea, 53 fathoms: its carapace is 5 millim. long and 6 millim. broad.

CERATOPLAX, Stimpson.

*Ceratoplax*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 96: Miers, Challenger Brachyura, p. 233.

Carapace deep, subquadrilateral with the antero-lateral angles rounded off, a good deal broader than long, the regions very indistinctly

and incompletely indicated, strongly convex fore and aft and anteriorly declivous.

Fronto-orbital border about two-thirds the greatest breadth of the carapace: antero-lateral borders sharp, entire, curved: postero-lateral borders parallel.

Front about a third the greatest breadth of the carapace, its free edge slightly arched, notched in the middle line.

The orbits are in the usual position and the eyestalks are immovably fixed in them, but the eyes are fairly well formed, though they may be deficient in pigment. The antennules fold transversely in proper pits. The basal antenna-joint is short: the flagellum, which is of good length, stands in the orbital hiatus.

Epistome well formed and prominent: buccal cavern quadrilateral, slightly increasing in breadth from behind forwards, almost completely closed by the external maxillipeds, the merus of which has the antero-external angle much produced and carries the flagellum at the antero-internal angle.

Chelipeds subequal, more massive but decidedly shorter than the legs; the palm short, deep, and compressed.

Legs slender, unarmed, the 3rd pair the longest: dactyli styliform.

The abdomen in both sexes consists of 7 separate segments and does not nearly occupy the space between the last pair of legs.

*Distribution:* Indo-Pacific from the Bay of Bengal to Ecuador.

#### *Key to the Indian species of Ceratoplax.*

- I. Surface of carapace nude, eyes well pigmented: outer surface of palm polished and nearly smooth ... .. *C. ciliata.*
- II. Surface of carapace tomentose, eyes deficient in pigment: rows of vesiculous granules on the outer surface of the palm ... .. *C. hispida.*

#### 22. *Ceratoplax ciliata*, Stimpson.

*Ceratoplax ciliatus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 96: A. O. Walker, Journ. Linn. Soc., Zool., XX. 1890, p. 110.

*Ceratoplax ciliata*, Miers, Challenger Brachyura, p. 234, pl. xix. fig. 3: Cass, Boll. Soc. Nat. Napol. III. 1889, p. 229.

Carapace, chelipeds and legs rather scantily fringed with hairs, but with a nude surface.

Carapace, length a little more than three-fourths the greatest breadth, sparsely punctate, the regions not distinguishable. Front about a third the greatest breadth of the carapace, its free edge slightly arched and notched in the middle line. Eyes well pigmented. Chelipeds decidedly shorter than the legs: inner angle of wrist sharp, but

not produced: outer surface of palm smooth and polished, except for a few depressed granules inferiorly. Third pair of legs not twice the length of the carapace.

In the Indian Museum is a single specimen from the Andaman Sea, 53 fms.

23. *Ceratoplox hispida*, n. sp.

Carapace, chelipeds and legs with a tomentose surface, and fringed with longer silky hairs.

Carapace, length a little less than three-fourths the breadth, when denuded its regions (and three gastric subregions) are just distinguishable, and its surface is pitted and its lateral margins granular. Front a little more than a third the greatest breadth of the carapace, its free edge decidedly arched and notched in the middle line. Eyes very deficient in pigment. Chelipeds (in the female—male unknown) much shorter than the legs: inner angle of wrist sharply dentiform; outer surface of palm with numerous rows of vesiculous granules. Third pair of legs two-and-a-half times the length of the carapace.

In the Indian Museum is a single specimen from Palk Straits: its carapace is 9 millim. long and 13 millim. broad.

TYPHLOCARCINUS, Stimpson.

*Typhlocarcinus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 96.

Carapace as in *Ceratoplox*. Fronto-orbital border about half the greatest breadth of the carapace. Front less than a fourth the breadth of the carapace, more or less distinctly bilobed. Antero-lateral borders well curved, often emarginate in places: postero-lateral borders parallel.

Orbits in the usual position, completely filled by the immovable eye-stalks: eyes obsolete, or nearly so. The antennules fold nearly transversely, in proper pits. Basal antenna-joint short; the flagellum, which is short, stands in the orbital hiatus.

Epistome well formed and prominent: buccal cavern completely, or almost completely, closed by the external maxillipeds, the flagellum of which articulates with the antero-internal angle of the merus; the outer angle of the merus not produced.

Chelipeds subequal or unequal, much more massive than the legs from which they do not much differ in length: palm short deep and compressed, with sharp upper and lower borders.

Legs slender, unarmed, the 3rd pair slightly the longest: dactyli styliform.

The abdomen in both sexes consists of 7 separate segments and does not nearly occupy all the sternum between the last pair of legs.

*Distribution:* Indo-Pacific, from the Persian Gulf to Hongkong.

From *Rhizopa*, of which we possess specimens from Hongkong, this genus differs only in having the eyes obsolete and the external maxillipeds more closely opposed to each other. It may well be doubted whether these differences are of generic value.

*Key to the Indian species of Typhlocarcinus.*

- I. Antero-lateral borders with 2 or 3 emarginations:—
  1. Buccal cavern decreasing in size from behind forwards: antero-external angle of merus of external maxillipeds obsolete and rounded off ... .. *T. nudus.*
  2. Buccal cavern quite square: antero-external angle of merus of external maxillipeds sharp ... .. *T. villosus.*
- II. Antero-lateral borders of carapace entire: buccal cavern quite square ... .. *T. rubidus.*

24. *Typhlocarcinus nudus*, Stimpson.

*Typhlocarcinus nudus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 96.

Carapace much transverse, its length only about five-eighths its greatest breadth, its surface smooth and bare, the regions hardly distinguishable. The posterior part of the antero-lateral border has two or three obscure notches.

The front, which is about a fifth the greatest breadth of the carapace, is grooved in the middle line—almost bilobed. Orbits broadly oval, almost subcircular.

Buccal cavern considerably decreasing in breadth from behind forwards: merus of the external maxillipeds with the antero-external angle obsolete and rounded off; the exognath very narrow.

Chelipeds and legs smooth, with only a few scant hairs on the margin. Chelipeds, in the male about twice the length of the carapace, a little longer than any of the legs: inner angle of wrist sharp, but not produced: palms unequal, smooth and polished, the upper border smooth and crest-like, the lower border with a distinct moulding.

In the Indian Museum are 25 specimens, from Karachi and the Mekrán coast, Madras coast and Sandheads, and the Andamans.

In this species a tiny speck of pigment denotes an eye.

25. *Typhlocarcinus villosus*, Stimpson.

*Typhlocarcinus villosus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 96  
Miers, P. Z. S., 1879, pp. 20, 40: Walker, Journ. Linn. Soc. Zool. XX. 1890, p. 110, pl. ix. figs. 6-8: Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 689.

Carapace and appendages everywhere covered with velvet. Carapace

about three-fourths as long as broad, its greatest breadth across the middle: when denuded it is granular in places and the regions are hardly distinguishable. Three blunt granular teeth on the lateral borders, two of which are antero-lateral, the third being postero-lateral.

Front between a fourth and a fifth the breadth of the carapace, bilobed: orbits piriform.

Buccal cavern quite square: antero-external angle of merus of external maxillipeds well marked but not produced, the exognath normal.

Chelipeds about twice as long as the carapace, and nearly the same length as the 3rd (longest) pair of legs, their outer surface, especially that of the palm, is granular: inner angle of the wrist produced, dentiform. The legs are fringed with coarsish hairs.

In the Indian Museum, besides a specimen from Hongkong, are 6 from various parts of the coast of the Bay of Bengal.

The carapace of the best specimen is 6 millim. long and 8 millim. broad.

In this species also there is a tiny speck of pigment for an eye.

#### 26. *Typhlocarcinus rubidus*, n. sp.

Carapace perfectly smooth and nude, except for a few hairs on the anterior and antero-lateral margins, its length a little over three-fifths its breadth, the regions hardly distinguishable, though the epibranchial regions have a decided dorsal bulge.

The antero-lateral borders, which, like the postero-lateral are blunt and granular, are quite entire.

Front about a fifth the breadth of the carapace, bilobed, the median groove very deep. Orbits piriform. Buccal cavern and external maxillipeds as in *T. villosus*.

Chelipeds and legs rather hairy, but there is always a large smooth bare space on the outer surface of the wrist and palm. Chelipeds about as long as the longest legs, less than twice the length of the carapace: inner angle of wrist produced, dentiform: below and above the bare patch on the wrist and hand the surface, when denuded, is granular.

The colour is a rich ruddy brown.

In the Indian Museum are 18 specimens from the Bay of Bengal, 20 to 65 fms.

The largest specimen has the carapace nearly 7 millim. long and 10 millim. broad, but there are egg-laden females smaller than this.

There is no pigment speck to represent an eye in this species.

#### XENOPHTHALMODES, Richters.

*Xenopthalmodes*, Richters, in Möbius Meeresf. Maurit. p. 155, 1880.

Carapace rudely semicircular in outline, the posterior border being

the longest, and the postero-lateral borders being anteriorly-convergent to form a common curve with the well-arched anterior and antero-lateral borders: it is but little broader than long, is convex fore and aft and strongly declivous anteriorly, and shows the regions indistinctly and incompletely.

Fronto-orbital border less than half, front less than a fifth, the greatest breadth of the carapace, the front being prominent and bilobed.

Orbits in the usual position, completely filled by the immovable eye-stalks: eyes obsolete. The antennules are small, and fold obliquely rather than transversely in proper pits. Basal antenna-joint short: the flagellum, which also is short, stands in the orbital hiatus.

Epistome and mouth parts, as also the abdomen, as in *Typhlocarcinus*.

Chelipeds a little unequal, much more massive and rather longer than the legs, of which the 3rd pair is slightly the longest. Palm short deep and compressed, with sharp edges.

Legs slender, unarmed: dactyli styliform.

*Distribution*: Indian Ocean, from Mauritius and the Red Sea to the Andamans.

This genus differs from *Typhlocarcinus* in having the carapace more elongate and more semicircular in outline, the front more prominent and narrower, and the antennules more cramped in consequence.

### 27. *Xenophthalmodes moebii*, Richters.

*Xenophthalmodes moebii*, Richters, in Möbius, Meerest. Maurit. p. 155, pl. xvi. fig. 29 and pl. xvii. figs. 1-5 1880: Miens, P. Z. S. 1834, pp. 10, 12: de Man, Notes Leyden Mus. XII. 1890, p. 68, pl. iii. fig. 5.

The carapace has rather a lop-sided look and is practically smooth, except for two rather deep semilunar impressions that incompletely separate the gastro-cardiac from the epibranchial regions: its surface is bare, but its free edges, like the edges of the chelipeds and legs, are thickly fringed with longish silky hairs: its length is about five-sixths the greatest breadth, which is quite posterior. Front very decidedly bilobed. Orbits oval. Buccal cavera very slightly decreasing in breadth anteriorly: the merus of the external maxillipeds has the antero-external angle rounded off.

Chelipeds in the male a little longer than the legs, and with the hands decidedly unequal: the inner angle of the wrist is acuminate: the upper edge of the palm is sharp and crest-like, the lower edge has a low granular crest or moulding, the surface of the palm is smooth and polished. The larger cheliped, measured along its convexities, is about twice the length of the carapace.



In the Indian Museum are 13 specimens, from the Persian Gulf, Malabar coast, Coromandel coast, Gulf of Martaban, and the Andamans. The carapace of the largest specimen is 10 millim. long and 12 millim. broad.

In one very young specimen the eye is represented by a tiny speck of pigment, as shown in de Man's figure, but in large specimens there is no trace of this speck.

#### SCALOPIDIA, Stimpson.

*Scalopidia*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 95: Miers, Challenger *Brachynura* p. 223.

*Hypophthalmus*, Richters, Abh. Senck. Nat. Ges. Frankfurt, XII. 1881, p. 429.

Carapace of but moderate depth, moderately convex fore and aft and but moderately declivous anteriorly: it is a good deal broader than long and inclines somewhat to a semicircular outline, the greatest breadth being quite posterior, the postero-lateral borders being anteriorly convergent, and the antero-lateral borders being nicely curved: the regions are distinctly mapped out by fine grooves.

Fronto-orbital border about two-fifths, front about a fourth the greatest breadth of the carapace: front rather obscurely bilobed, antero-lateral borders acute.

Eyes minute, eyestalks fixed in small orbits which lie entirely beneath the anterior border of the carapace. The antennules fold transversely in shallow and rather inadequate pits. Basal antenna-joint short; the flagellum, which is of moderate length, stands quite clear of the orbital hiatus.

Epistome sunken, not well demarcated from the edge of the buccal cavern: the latter is squarish and broader in front than behind. There is a considerable gap between the external maxillipeds, the merus of which is square and has a sharp antero-external angle and carries the flagellum at the antero-internal angle.

Chelipeds a little unequal, much shorter and not much more massive (except as regards the larger palm) than the third pair of legs: palm short and compressed, with sharp edges.

The legs have the merus broadened, especially in the case of the 2nd and 3rd pair: the 3rd pair is considerably the longest.

The abdomen consists of 7 separate segments, and does not nearly occupy all the sternum between the last pair of legs.

*Distribution*: Indo-Pacific, from Madagascar to China.

#### 28. *Scalopidia spinosipes*, Stimpson.

*Scalopidia spinosipes*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 95: J. E. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 379.

Carapace and appendages downy. Carapace, length about two-

thirds the greatest breadth, its surface closely punctate: all the regions are quite plainly defined by grooves, which also subdivide the gastric into three subregions, and the epibranchial into two—an anterior and a posterior; and the cardiac region has a distinct bulge. The sharp-cut antero-lateral borders are, like the anterior border, very finely serrated, and are marked off from the blunt postero-lateral borders by a minute spine.

The larger cheliped is barely half again as long as the carapace: both chelipeds have the lower edge of the arm finely serrated, have a spinule near the far end of the upper border of the arm and one at the outer angle of the wrist, and have the inner angle of the wrist strongly dentiform.

The legs have their edges, except in the case of the dactyli, closely and evenly spinulate, but there is a tendency for the spines to fall on the posterior edge of the carpus and propodite. The 3rd pair, which are considerably the longest, are much more than  $2\frac{1}{2}$  times the length of the carapace. The legs increase remarkably in length from the 1st to the 3rd, and the 4th are about the same length as the first. The dactyli are sharp, strong, styliform and ciliated: those of the last pair are curved, those of the other pairs are straight.

Henderson records this species from the Gulf of Martaban: the only specimens in the Indian Museum are from Hongkong.

#### 29. TYPHLOCARCINODES, n. gen.

Apparently one of the links between *Typhlocarcinus* and its allies on the one hand and *Scalopidia* on the other.

Carapace moderately deep, shaped much as in *Typhlocarcinus*, but slightly more elongate, the free edges hairy. Fronto-orbital border about three-fifths, front about a third, the greatest breadth of the carapace: front prominent, its free edge convex and entire.

Orbits in the normal position, narrow, button-hole shaped; eye-stalks tapering, immovable; eyes obsolete or nearly so. *Antennules cramped, folding very obliquely—nearly longitudinally*—in proper pits. Antennal peduncle small and cramped, the flagellum standing in the orbital hiatus.

*Epistome sunken, linear*: buccal cavern square, its anterior angles, like the antero-external angles of the merus of the external maxillipeds, rounded off: the external maxillipeds completely close the buccal cavern and have the flagellum articulated to the antero-internal angle of the merus.

The abdomen does not nearly occupy all the space between the last pair of legs.

The above diagnosis is framed on a broken specimen, without chelipeds or legs, in the Indian Museum. In the form of the front and shape of the carapace this specimen has a strong resemblance to the *Typhlocarcinus integrifrons* described and figured by Miers in *Anu. Mag. Nat. Hist.* (5) VIII. 1881, p. 260, pl. xiv. fig. 1. Miers himself was doubtful about referring his species to *Typhlocarcinus*.

Our specimen is too much damaged to furnish a useful specific diagnosis.

#### HEPHTHOPELTA, Alcock.

*Hepthopelta*, Alcock, Investigator Deep Sea Brachyura, p. 76.

Carapace very deep, inflated, rudely semicircular, about as long as broad, convex fore and aft and vertically deflexed anteriorly, all its borders entire and all, except the posterior, tumid, the cardiac and branchial regions well delimited.

Front considerably less than a third the greatest breadth of the carapace, bilobed, vertically deflexed; the whole extent of the fronto-orbital border is more than half the greatest breadth of the carapace.

Orbits small, shallow, excavated in the vertically-deflexed anterior border of the carapace, not concealing the eyes. Though the eyes are small and their stalks immovably fixed, they are *well formed, well defined and well pigmented*.

*The antennular fossæ are completely filled by the basal antennular joint, to the exclusion of the flagella.*

The basal antenna-joint is small, slender, and does not nearly reach the front; the flagellum, which arises in the orbital hiatus, is hardly longer than the orbit.

The epistome is of considerable width fore and aft and, though sunken, is well defined from the palate. The buccal cavern is square, though very slightly narrower in front than behind: the excurrent branchial canals are well defined. The external maxillipeds, which completely cover the buccal cavern, have the merus shorter and slightly narrower than the ischium and somewhat oval in shape, and the palp jointed to the antero-internal angle of the merus and of good size.

The legs are all long and slender and end in a slender dactylus: the third pair are slightly the longest.

The chelipeds are lost in the single specimen obtained, which is a female.

#### 30. *Hepthopelta lugubris*, Alcock.

*Hepthopelta lugubris*, Alcock, Investigator Deep Sea Brachyura, p. 77. pl. iv, fig. 2.

Carapace as long as broad, roughly semicircular or semiglobose, of thin texture, its surface very finely frosted and somewhat pubescent.

The fronto-orbital region is vertically deflexed and almost invisible in a dorsal view.

Epibranchial and cardiac regions tumid, circumscribed by deepish grooves.

Legs subcylindrical, with a finely frosted and pubescent surface: the third pair, which are slightly the longest, are about  $2\frac{1}{2}$  times the length of the carapace: the posterior (lower) border of the merus of the first two pairs is spinulose.

Colours in spirit, light yellow, eyes black.

A single female, without chelipeds, from the Andaman Sea, 490 fms. The carapace is 8 millim. long, and the same in breadth.

#### CAMATOPSIS, Alcock.

*Camatopsis*, Alcock, Investigator Deep Sea Brachyura, p. 75.

Carapace deep, rudely sub-semicircular, hardly broader than long, strongly convex fore and aft and declivous anteriorly: its antero-lateral borders short sharp and entire, its postero-lateral borders long sharpish and slightly convergent anteriorly: its only markings are two longitudinal grooves hardly visible on the undenuded carapace, that mark off the epibranchial regions.

Front considerably less than a fourth the greatest breadth of the carapace, obscurely bilobed; the whole fronto-orbital border is about half the greatest breadth of the carapace.

Orbits large, deep, and normally cut in the anterior border of the carapace: eyestalks large, tumid, conical, almost immovably fixed in the orbits: eyes reduced to a speck of pigment placed on the under surface of the tip of their stalks.

Antennular fossæ small, and filled entirely by the basal antennular joint, to the complete exclusion of the large flagellum.

The small basal antenna-joint is wedged in between and beneath the eyestalk and antennule, the second joint hardly reaches to the front, the flagellum is large and considerably longer than the orbit.

The epistome is of considerable width fore and aft, especially at its middle, and though sunken, is well separated from the palate. The buccal cavern is square, though rather broader in front than behind, and is almost entirely covered by the external maxillipeds. These have the merus as long as, and markedly broader than the ischium, owing to the strongly convex bulge of the outer border of the merus: the palp, which is of good size, is jointed to the antero-internal angle of the merus.

The chelipeds are moderately massive and in the male the hands are unequal. The arm is short and trigonal, the wrist rather long narrow and crooked.

Legs sufficiently long and stout, the penultimate pair being the longest; their dactyli are sharply trigonal and elegantly plumose: the last pair have the dactylus slightly curved and compressed.

The abdomen of the male, which is four-jointed, does not nearly fill the space between the last pair of legs.

Between the 4th and 5th segments of the sternum, in the male, is intercalated a long narrow plate that covers the external genital ducts.

### 31. *Camatopsis rubida*, Alcock and Anderson.

*Camatopsis rubida*, Alcock and Anderson, Ann. Mag. Nat. Hist. Jan. 1899, p. 13: Alcock, Investigator Deep Sea Brachyura, p. 76, pl. iv. fig. 3.

Carapace very finely granular when denuded of the short velvet that covers it and all parts of the body and appendages. The narrow front and the antero-lateral borders form a semicircular curve: the postero-lateral borders are anteriorly convergent, the greatest breadth of the carapace being between the bases of the penultimate pair of legs. The tumid anterior (true inner) borders of the eyestalks bulge beyond the orbital concavities of the anterior border of the carapace.

The efferent branchial canals cause an angular bulging or carination of the pterygostomian regions.

The chelipeds are unequal in the male (female unknown), the longer one being about  $1\frac{1}{2}$  times the length of the carapace. They are unarmed. In the larger hand the fingers meet only at tip and are finely toothed in the distal half only, being rather deeply notched in the basal half, while on the inner surface of the movable finger is a curious truncated spine. In the smaller hand the fingers meet throughout their extent and only the immovable finger is distinctly toothed, one or two of its teeth being enlarged.

The first and last pair of legs are about  $1\frac{1}{2}$  times, the second and third pair are about twice, the length of the carapace. In the last pair of legs the terminal joints are more strongly ciliated, and the dactylus is slightly curved and compressed as for swimming.

Colours in spirit rich chocolate brown. Animal entirely covered with velvet.

Three males from the Andaman Sea, 194 fathoms. The carapace of the largest is 9 millim. long and 10 millim. broad.

### Subfamily iv. HEXAPODINÆ, Miers.

#### LAMBOPHALLUS, nov. gen.

Near *Hexapus*, De Haan, from which it chiefly differs in the form of the anterior pair of male sexual appendages, which are rigidly bent

into the form of an L, the horizontal limb of which is lodged in a special trench in the first segment of the sternum.

Carapace much broader than long, broadest behind. Front narrow, nearly vertically deflexed. Orbits small, circular, widely communicating with the antennular fossæ. The antennules fold transversely. Antennæ small, standing in the orbital hiatus.

Epistome well-defined. Buccal cavern with the sides slightly convergent anteriorly. The external maxillipeds have coarse palps, which, when folded, fill the rather broad space that exists between the ischiopodites: the merus is subquadrilateral, with the antero-external angle rounded off, and the palp articulates with its antero-internal angle: the exognath is not concealed.

Chelipeds unequal in the male, shorter but more massive than the legs.

*Only three pairs of legs, the fourth pair entirely absent.*

Sternum extremely broad. Abdomen of the male very narrow. The efferent ducts of the male sex open on the 4th sternal segment inside the fossa into which the abdomen fits.

### 82. *Lambdophallus searpes*, n. sp.

Resembles *Hexapus searpus*, De Haan, with a specimen of which I have compared it, but differs in numerous important characters.

Carapace subquadrilateral with the anterior angles broadly rounded off, much broader than long, convex fore and aft and anteriorly deflexed, nearly flat from side to side, the gastric and cardiac regions well defined, the surface uniformly finely granular under a lens.

Front nearly vertically deflexed, its edge square-cut but grooved or notched in the middle line, its breadth about a fifth the greatest breadth of the carapace.

Orbits freely communicating with the antennular fossæ: eyestalks immovable and very short, eyes small but well pigmented.

Antennules large, folding transversely; the inter-antennular septum narrow if complete.

Epistome lozenge-shaped, well defined: the sides of the buccal cavern converge slightly from behind forwards: the ischiopodites of the external maxillipeds are rather narrow and leave between them a widish gap, which, however, is filled by the flagella.

There is a deep crescentic groove across the pterygostomial region, just in front of the bases of the chelipeds, and there are several close-set oblique scorings near the antero-lateral angles of the buccal cavern.

Chelipeds in the male unequal, more massive than the legs, the larger one not  $1\frac{1}{2}$  times the length of the carapace: under the lens their

outer surface is very finely and uniformly granular: the fingers are short, especially in the larger hand, and meet only at tip, and at the base of the dactylus of the larger hand is a molariform tooth.

Legs tomentose: only 3 pairs are present, the 4th pair not being represented even by a rudiment. The first pair, which are not much longer than the chelipeds, are the shortest and slenderest: the next two pairs, which are about equal in size, are not quite twice the length of the carapace.

Sternum very broad, finely and uniformly granular: in the male, in the first sternal segment, on either side of the last abdominal tergum, is a long narrow oblique trench, in which the ends of the modified abdominal appendages are lodged.

Male abdomen very narrow, not a fifth the breadth of the sternum at its base. The first tergum is short fore and aft, the second is linear and has a somewhat trilobed form, the 3rd 4th and 5th are fused to form a sort of hexagonal plate with the distal end narrowed, the 6th and 7th are separate.

The anterior of the two pairs of male abdominal appendages are most curiously modified: they are very long and stiff and are L shaped, and the proximal limb of the L lies beneath and parallel with the abdomen, while the distal limb of the L emerges at right angles to the abdominal tergum, and, instead of being free, lies in the special sternal canal before mentioned.

In the Indian Museum are 2 specimens, from the Bay of Bengal, 65 fathoms. The carapace is 4.5 millim. long and 7 millim. broad.

## Family II. PINNOTERIDÆ, Edw.

### *Key to the Indian genera of Pinnoteridæ.*

- I. Carapace ill-calcified: the ischium of the external maxillipeds is indistinguishably fused with the much enlarged merus:—
  1. Edges of the carapace swollen and ill-defined: dactylus of the external maxillipeds small and often abnormally placed, but present ..... PINNOTERES.
  2. The edge of the carapace, in all but its short fronto-orbital portion, forms a thin upturned crest: dactylus of the external maxillipeds wanting, or represented by a tiny pencil of hairs ..... XANTHASIA.
- II. Carapace well calcified: the ischium of the external maxillipeds is distinct and independent:—
  1. Ischium of the external maxillipeds much smaller than the merus: dactylus of the external maxillipeds very large, spatulate. Orbits and eyes normal, the orbits circular ..... TETRIAS.

2. Ischium of the external maxillipeds as well developed as the merus, the dactylus not enlarged. The orbits are narrow slits situated dorsally with their long axis almost at right angles with the anterior border of the carapace, and the eyes are minute or obsolescent ..... **XENOPHTHALMUS.**
3. Ischium of the external maxillipeds very much larger than the merus, the appendages as a whole being slender and not nearly closing the buccal cavern. The orbits are in the usual marginal position..... **CHASMOCARCINOPS.**

Subfamily **XENOPHTHALMINÆ**, nov.

**XENOPHTHALMUS**, White.

*Xenopthalmus*, White, Ann. Mag. Nat. Hist. XVIII. 1846, p. 177: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 220: Burger, Zool. Jahrb., Syst. VIII. 1894-95, p. 386.

Carapace broader than long and broadest behind, arched antero-laterally, the regions faintly indicated. Front narrow, strongly deflexed.

*The orbits are small, oblique or nearly longitudinal, button-hole like slits, placed dorsally almost at right angles to the frontal border, and the eyestalks are immovably embedded in them. The eyes are, at most, minute specks of pigment. The antennules and antennæ are extremely small, the antennules folding nearly vertically beneath the front.*

Epistome not defined. Buccal cavern almost semicircular, completely closed by the external maxillipeds. The external maxillipeds have the ischium and merus equally well developed (the ischium being nearly square and the merus about a quadrant of a circle) and the palp articulated at the antero-external angle of the merus. Exognath small and concealed.

Chelipeds in the male "with the hands somewhat elongated and thickened," in the female short and very slender.

Legs fairly stout, the third pair the longest.

The abdomen in both sexes consists of seven separate segments.

*Key to the Indian species of Xenopthalmus.*

- I. The legs are ciliated and the third (longest) pair are not twice the length of the carapace ... **X. pinnoteroides.**
- II. The legs are ciliated towards the tip only, and the third (longest) pair are more than twice the length of the carapace ..... **X. obscurus.**

33. *Xenopthalmus pinnoteroides*, White.

*Xenopthalmus pinnoteroides*, White, Ann. Mag. Nat. Hist. XVIII. 1846, p. 178, pl. ii. fig. 2, and Samarang Crust. p. 63, pl. xii. fig. 3: Milne Edwards, Ann. Sci.



Nat., Zool., (3) XX. 1853, p. 221 : Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 107 : Sluiter, Tijds. Nederl. Ind. XL. 1881, p. 162 : J. E. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 394.

This species is included in the Indian Fauna on the authority of Professor J. E. Henderson. It seems to be characterized by having the ischium and merus of the external maxillipeds deeply grooved, longitudinally, near the outer margin ; the legs stout and hairy, the third pair barely twice as long as the carapace ; and the three terminal joints of the first pair of legs broadened so that their edges are almost carinate: the lateral borders of the carapace are granular or finely denticulate.

#### 34. *Xenophthalmus obscurus*, Henderson.

*Xenophthalmus obscurus*, J. E. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 394, pl. xxxvi. figs. 18, 19.

Carapace glabrous and shiny, but its surface is somewhat creased : the median regions are separated from the branchial regions by grooves or depressions, and each branchial region is traversed obliquely in its posterior part by a low ridge.

The rounded-off antero-lateral corners of the carapace are traversed by three low fine ridges, nearly parallel with one another : one of these defines the pterygostomial region, the next appears to be the true antero-lateral border, while the most dorsal one runs from the angle of the orbit to the junction of the antero-lateral and postero-lateral borders.

Front narrow, nearly vertically deflexed, longitudinally grooved in the middle line, its free edge square-cut but faintly sinuous. The eyes are just visible as minute linear specks, placed posteriorly.

No epistome. The ischium and merus of the external maxillipeds are not deeply grooved near the outer border.

Chelipeds in the female shorter and much slenderer than the first and last pair of legs.

The 3rd pair of legs are the longest, being about  $2\frac{1}{4}$  times the length of the carapace : the second pair, though a little shorter than the 3rd, are equally stout. The first and last pairs are about equal to one another in size (in the female) being hardly longer than the carapace, and slenderer than the other legs. The terminal joints of all the legs are hairy : the posterior borders of the meropodites of the first three pairs are spiny, the anterior border being very finely serrulate.

In the Indian Museum are two females, one, with eggs, from off the Ganjam coast, 20 fathoms, the other from the Andamans. The carapace in the larger female is 6 millim. long and 8 millim. in greatest breadth.

## Subfamily ASTHENOGNATHINÆ, Stimps.

## CHASMOCARCINOPS, n. gen.

Carapace deep, convex fore and aft and declivous anteriorly: its greatest breadth is quite posterior, so that the postero-lateral borders, which are blunt, are anteriorly-convergent, though slightly so: the antero-lateral borders are sharp and form an elegant curve with the anterior border: the regions are nearly as well defined as they are in *Scolopidia*: its length is hardly less than its breadth.

The fronto-orbital border is considerably more than a third, but the front (which is bilobed) is only about a sixth, the greatest breadth of the carapace.

The orbits, which are in the usual marginal position, are small, and the eyestalks, which are immovable, are shrunk within them: the eyes are minute.

The antennular flagella are large and cannot be retracted into the antennular pits, which are filled entirely by the basal joint.

The antennal flagella are long—considerably more than a third the length of the carapace—and stand in the orbital hiatus.

Epistome sunken and not altogether well demarcated from the palate. The buccal cavern has its antero-external angles rounded off, and is not nearly closed by the external maxillipeds: these have the merus much shorter and narrower than the ischium, oval and somewhat oblique, and the flagellum appears to articulate with the summit of the merus.

The chelipeds are about as long as the legs and are very unequal in the male.

The third pair of legs are slightly the longest. As in *Scolopidia* the dactylus of the last pair of legs is recurved.

The abdomen in both sexes is narrow, not nearly occupying all the space between the last pair of legs, and in the male consists of 5 pieces, the 3rd-5th segments being fused. In the male also, as in *Camatopsis*, there is, on either side, a narrow plate intercalated between the 4th and 5th segments of the sternum and covering the external genital ducts.

This genus more clearly than any other connects the *Rhizopinæ* and the *Pinnotheridæ* together.

35. *Chasmocarcinops gelasimoides*, n. sp.

Carapace nearly as long as broad, its surface abundantly sprinkled with vesiculous granules, its free margins rather sparsely ciliated: all the regions are distinguishable, and the cardiac and posterior lobe of the gastric regions are defined by deep impressions: the antero-lateral

borders are sharply defined and granular. Front very distinctly bilobed, prominent.

Chelipeds in the male very unequal, the larger one being twice as long as the carapace, its chief bulk being contributed by the hand, which, with its large swollen polished palm and long crooked fingers meeting only at tip, recalls that of *Gelasimus*. The smaller cheliped (like the female chelipeds) is not much shorter than the larger one and, like it, has the articulation of the wrist confined to a rather prominent postero-inferior lobe of the hand, and the fingers longer than the palm: the chief difference is that the palm is not enlarged and swollen and that the fingers meet throughout almost all their extent. In both chelipeds the surfaces of all the segments are smooth, and there are sharpish granules along the borders of the arm and at the not very pronounced inner angle of the comparatively slender wrist.

The legs, like the fingers of the smaller cheliped, are fringed, but not very thickly, with hair. The 3rd pair are very slightly the longest, being twice the length of the carapace. The edges of the meropodites are furnished with sharp granules and spinules, these being abundant in the case of the first 3 pairs and rather few on the 4th pair. In the first 3 pairs also the carpopodites are of good length and subcylindrical, and the dactyli straight and almost styliform; but in the 4th pair the two terminal joints are compressed, the carpopodite being shortened and the dactylus recurved.

A male and a female from off Madras, 12 fathoms. The carapace of the male is 11 millim. long and 12 millim. broad.

#### Subfamily PINNOTHERELINÆ.

##### TETRIAS, Rathbun.

*Tetrias*, Rathbun, Proc. U. S. Nat. Mus. XXI. 1898, p. 607.

Carapace strongly calcified, broader than long, deep, subquadrangular, dorsally flattish, anteriorly declivous, the regions faintly indicated.

Front between a third and a fourth the greatest breadth of the carapace, its edge only deflexed, not directly united to the epistome. Orbits circular, small: eyestalks short, eyes small. The antennules fold a little obliquely from the transverse. Antennæ small, the flagellum in the orbital hiatus.

Epistome well defined: buccal cavern broadish, quadrilateral. External maxillipeds large, their palp about as large as their merus and ischium combined: ischium distinct, small; merus very large, carpus large and triangular and articulating at the antero-external

angle of the merus, propodite large and articulating with the end of the carpus, dactylus large and spathulate and articulating with the inner angle of the propodite: exognath small and a good deal concealed.

Chelipeds equal, short: the chelipeds in the male equal, and much stouter than the legs.

First 3 pairs of legs coarse, not differing much from each other or from the chelipeds in length, though the second pair are slightly the longest. The fourth (last) pair are very much smaller than the others.

The abdomen of the male is narrow and consists of 7 separate segments.

*Tetrias* differs very little from *Pinnixa* of which it might, perhaps, be regarded as a subgenus.

*Distribution*: Indo-Pacific, Andamans to California.

### 36. *Tetrias Fischeri*, (A. M. E.).

or *Pinnixa (Tetrias) Fischeri* (A. M. E.).

*Pinnotheres Fischeri*, A. Milne Edwards, Ann. Soc. Entomol. France, VII. 1867, p. 287.

*Pinnixa Fischeri*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 319, pl. xviii. fig. 3: de Man, Archiv fur Naturges. LIII. 1887, i. p. 385, pl. xvii. fig. 2.

Carapace and appendages everywhere covered by a close adherent coat of short hair. The regions of the carapace are fairly well indicated and its dorsal surface is closely and finely granular, except in the middle where also the hair is somewhat deficient. Deflexed edge of the front broadly triangular. Eyes well pigmented. The inner edge of the carpus and the inner and distal edges of the large spathulate dactylus of the external maxillipeds are fringed with a close row of hairs of extraordinary length.

Chelipeds in the male much more massive than the legs, and about  $1\frac{1}{2}$  times the length of the carapace: their movements are somewhat restricted. There are some spinules at the inner angle of the wrist, and numerous rows of granules—the lowermost row rather acute—on the outer surface of the palm: the fingers, which are shorter than the palm, are stumpy but sharp-pointed.

The first 3 pairs of legs are coarse and are all about  $1\frac{1}{2}$  times the length of the carapace, though the second pair are very slightly the longest. The 4th pair are very short—not two thirds the length of the carapace—and are much slenderer than the others. All the legs have a shaggy posterior border, and all end in small hooked dactyli. The posterior border of the meropodite of the last pair is armed with small coarse spines.

The abdomen of the male is narrow and consists of 7 segments: the first two segments are very short, the 3rd 4th and 5th gradually increase in length and slightly decrease in breadth, the 6th is a little shorter than the 5th, and the 7th is long and spathulate and encroaches on the buccal cavern.

In the Indian Museum is a single male specimen, from coral, from the Andamans: its carapace is a little over 5 millim. long and 7 millim. broad.

### Subfamily PINNOTERINÆ.

#### \*PINNOTERES, Latreille.

*Pinnotheres*, Latreille, Hist. Nat. Crust. et Ins. VI. p. 78, and Gen. Crust. et Ins., p. 34: Lamarck, Hist. Nat. An. Sans. Vert. (2nd edit. Vol. V. p. 410): Boec, Hist. Nat. Crust. I. p. 239: Leach, Malac. Pod. Britt.: Desmarest, Consid. Gen. Crust. p. 116: De Haan, Faun. Japon. Crust., p. 34: Milne Edwards, Hist. Nat. Crust. II. 30, and Ann. Sci. Nat., Zool., (3) XX. 1853, p. 216: Dana, U. S. Expl. Exp. Crust. pt. I. p. 278: Bell, British Stalk-eyed Crust. p. 119: Miers, Challenger Brachyura, p. 275: Ortmann, Zool. Jahrb., Syst., VII. 1894, p. 698: Bürger, Zool. Jahrb. Syst., VIII. 1894-95, p. 362: Adensamer, Ann. Nat. Hofmus., Wien, 1897, p. 105.

Carapace often ill calcified, generally convex with ill-defined edges, in shape transversely oval, or circular, or subquadrangular or sub-hexagonal with rounded angles, the surface generally smooth, the regions seldom defined.

Front narrow, generally deflexed in the female if not in the male. Orbits small, circular, eyestalks short, eyes small. Antennules folding obliquely in small pits. Antennæ small, the minute flagellum standing in the inner angle of the orbit.

Epistome well defined. The buccal cavern is of a curious crescentic shape, being arched and very broad from side to side, but very narrow fore and aft. The external maxillipeds completely close the buccal cavern: they consist chiefly of the merus, which is fused with the ischium to form a single large obliquely-directed joint carrying the flagellum at its inner end: the flagellum is small though its propodite may be spathulate, and the dactylus is often inserted on the inner or flexor border of the propodite: the exognath is for the most part concealed.

The chelipeds and legs are short, the chelipeds being equal and generally, even in the female, stouter than the legs.

The abdomen in the male is narrow, in the female it is generally larger than the sternum: it consists of 7 separate segments.

\* *Pinnotheres*, the correct transliteration of the Greek word, was used by Rumph in 1705, so that no apology is necessary for reverting to it.

The Pinnoteræ live as parasites or messmates, generally within the mantles of Lamellibranch Mollusks.

*Key to the Indian species of Pinnoteræ.*

- I. The dactylus of the external maxillipeds is articulated far back on the inner or flexor edge of the propodite: the eyes in the female are not entirely visible in an ordinary dorsal view:—
  1. The dactyli of all the legs are about equal:—
    - i. Carapace somewhat octagonal in outline, with deepish tomentose pits separating the branchial from the median regions: first three pairs of legs nearly equal in length: dactyli of all the legs of fair length..... *P. Edwardsi.*
    - ii. Carapace circular, perfectly smooth: second pair of legs decidedly the longest: dactyli of all the legs very short..... *P. mactricola.*
  2. Dactylus of the 3rd pair of legs longer than any of the others ..... *P. purpureus.*
  3. Dactylus of the 4th pair of legs longer than any of the others ..... *P. parvulus.*
- II. The dactylus of the external maxillipeds is articulated to the tip of the propodite: the eyes in the female are entirely dorsal ..... *P. abyssicola.*

37. *Pinnoteræ Edwardsi*, de Man.

*Pinnoteræ Edwardsi*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 103, pl. vi. figs. 6-9 (1889).

The description applies to the female.

The length of the carapace is nearly equal to the greatest breadth. Carapace octagonal in shape, with the angles rounded: its dorsal surface little convex, with tomentose depressions of some size and depth separating the median from the branchial regions. The deflexed part of the front is very distinctly triangular. Eyes very small, but deeply pigmented.

Dactylus of external maxillipeds slender and inconspicuous; placed far back on the inner edge of the spatulate propodite.

Chelipeds and legs more or less downy, especially on their under surface. Chelipeds nearly as long as the carapace, a little longer and much stouter than the legs, unarmed: dactylus as long as the upper border of the palm.

Legs rather coarse: the first 3 pairs are about equal in length, the 4th pair is a little shorter.

Carapace 15 millim. long and 16 millim. broad.

From an *Ostræa* from Mergui.

38. *Pinnotheres purpureus*, n. sp.

Closely related to *P. palaensis*, Bürger.

The description applies to the female.

Carapace and appendages smooth, polished, nude. Carapace transversely oval, strongly convex, the regions not well defined. Deflexed part of front broadly and indistinctly triangular. Eyes very small, but well pigmented.

Dactylus of external maxillipeds slender and inconspicuous, placed far back on the inner (flexor) edge of the propodite.

Chelipeds and legs slender, the chelipeds being little stouter than the legs and about the same length as the first pair of legs. The movable finger is not much more than half the length of the upper border of the palm.

The third pair of legs are the largest of all, their meropodites and carpopodites being longer than those of the first two pairs and nearly twice as long as those of the 4th pair. The dactyli of the 3rd and 4th pairs are several times the length of those of the first two pairs, and the dactylus of the 3rd pair exceeds that of the 4th pair. Though the 4th pair have a long dactylus their total length is not greater than that of either of the first two pairs.

Colour either hyaline with numerous minute specks of bluish-black pigment, or the specks may be sufficiently numerous to make the whole animal nearly black.

From an *Ostræa* from the Andaman Islands.

Carapace 7 millim. long and 9 millim. broad.

39. *Pinnotheres parvulus*, Stimpson, de Man.

*Pinnotheres parvulus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 108; de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 105, and Archiv für Nat. LIII. 1887, i. p. 383; Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 699; Bürger, Zool. Jahrb., Syst., VIII. 1894-95, pp. 363, 376, pl. ix. fig. 18 and x. fig. 17.

A single damaged female appears to differ from *P. purpureus* only in the following particulars:—

(1) though the 4th pair of legs are shorter than the 3rd, they are decidedly longer than the 2nd, and still more decidedly longer than the 1st.

(2) the dactylus of the 4th pair of legs is the longest of all.

40. *Pinnotheres mactricola*, n. sp.

Closely related to *P. cardii*, Bürger.

The description applies to the female.

Carapace perfectly circular smooth and polished, convex. Edge of front nearly straight. Eyes minute, well pigmented.

Dactylus of external maxillipeds slender and inconspicuous, arising far back on the inner (flexor) edge of the propodite.

Chelipeds decidedly stouter than the legs and about as long as the first pair of legs: their inner border is scantily fringed with hair: their dactylus is nearly two-thirds the length of the palm.

Legs slender, fringed with hairs: the second pair are decidedly the longest—a little longer than the carapace: the fourth pair are decidedly the shortest: the first and third pairs are about equal in length: in all four pairs the dactyli are equally short.

From *Maetra violacea*, from the mouth of the R. Hooghly.

Diameter of carapace not quite 6 millim.

In the male the front is a little prominent and the chelipeds are very much stouter.

#### 41. *Pinnoteres abyssicola*, Alcock and Anderson.

*Pinnoteres abyssicola*, Alcock and Anderson, Ann. Mag. Nat. Hist. (7) III. 1899, p. 14: Alcock, Investigator Deep Sea Brachynura, p. 81.

The description applies to the female.

Carapace subcircular, smooth, convex. Front rather prominent, little deflexed, broadly triangular. Eyes of good size but deficient in pigment, entirely dorsal.

The palp of the external maxillipeds is minute and is much concealed by hairs that fringe the prominent internal angle of the merus: the dactylus is borne at the tip of the propodite.

Chelipeds much stouter than the legs, nude except for a fringe of hairs on the lower border of the immobile finger: they are about as long as the carapace, and the dactylus is not much shorter than the upper border of the palm.

Legs slender, nude: the 2nd and 3rd pairs are slightly longer than the 1st and 4th, being nearly  $1\frac{1}{2}$  times the length of the carapace: the dactyli also of the 2nd and 3rd pairs are a little longer than those of the 1st and 4th.

From *Lima indica*, from 430 fathoms off the Travancore coast.

Diameter of carapace 8 millim.

#### XANTHASIA, White.

*Xanthasia*, White, Ann. Mag. Nat. Hist. XVIII. 1846, p. 176: Dana, U.S. Expl. Exp., Crust., pt. I. p. 383: Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1853, p. 221: Bürger, Zool. Jahrb., Syst., VIII. 1894-95, p. 336.

Resembles *Pinnoteres* in structure and habit, but differs in the following particulars:—

The edge of the carapace is well defined and, in all but its fronto-



orbital portion, forms an upturned crest, so that the dorsal surface of the carapace is depressed and saucer-like. Other crests are found on the dorsal surface of the carapace and, in the centre, a large mushroom-like tubercle.

Though it is on an inferior plane, the narrow front is prominent and not deflexed.

The buccal cavern and mouth-parts have the same curious form, except that (owing to the encroachment of the epistome in the middle line) the anterior edge of the buccal cavern is bilobed or bow-shaped rather than semicircular, and the dactylus of the external maxillipeds is wanting or is represented by a few hairs.

*Distribution* : Indo-Pacific, from the east coast of Africa to Fiji.

#### 42. *Xanthasia murigera*, White.

*Xanthasia murigera*, White, Ann. Mag. Nat. Hist. XVIII. 1846, p. 177, pl. ii. fig. 3: Dana, U. S. Expl. Exp., Crust. pt. I. p. 384, pl. xxiv. figs. 6 a-b: Milne Edwards, Ann. Sc. Nat., Zool., (3) XX. 1853, p. 221: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 321: Haswell, Cat. Austral. Crust. p. 118: Miers, Zool. H. M. S. Alert, pp. 518, 546: de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 106: Bürger, Zool. Jahrb., Syst. VIII. 1894-95, p. 386, pl. x. fig. 33: Adensamer, Ann. KK. Nat. Hofmus. Wien, XII. 1897, p. 109: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 264.

The edge of the carapace is formed, in all but its short fronto-orbital portion, by a thin sharp upturned overhanging crest, which ends in a curl on the anterior part of either branchial region.

A large mushroom tubercle, having a rough or reticulate surface and a more or less reniform outline, occupies the middle of the dorsal surface of the carapace, and between this and the front is a pair of parallel longitudinal crests.

The front is somewhat prominent and is dorsally grooved or obscurely bilobed, and on each side of it, beyond the small orbits, is a small wing-like projection.

Chelipeds not, or hardly, stouter than the legs: the dactylus in the male is about two-thirds, in the female not much more than half the length of the palm.

Legs rather coarse: the first three pairs, which are about equal to one another and to the chelipeds in length, are about as long as the carapace, the fourth pair are a little shorter: the dactyli in all are about equally short.

In the female the broad abdomen is traversed longitudinally by a sort of coarse interrupted carina.

In the Indian Museum are 5 specimens from the Andamans and Mergui. The carapace of the largest female is 11.5 millim. long and 15.5 millim. broad.

The *Xanthasia* sp., or *Xanthasia Whitei*, from Mergui, referred to by de Man in Journ. Linn. Soc., Zool., XXII. 1887-88, p. 106, pl. vii. fig. 1 is represented in the collection by a single small male and is characterized by having the upraised edge of the carapace blunt and rounded, instead of thin and acute, and the median tubercle of the carapace ill defined instead of sharply circumscribed: the posterior margin of the carapace, also, is more prominent and is not quite continuous with the lateral margins. The legs also are somewhat longer.

Family OCYPODIDÆ, Ortmann, emend.

*Key to the Indian genera of Ocypodidæ.*

- I. A hairy-edged pouch leading into the branchial cavity, between the bases of the 2nd and 3rd pair of true legs [*Ocypodinæ*]:—
1. Antennular flagella rudimentary, completely hidden beneath the front: antennæ small, almost rudimentary: eyes very large, occupying the greater part of the ventral surface of the eyestalks: chelipeds very unequal in both sexes ..... OCYPODA.
  2. Antennular flagella small, not hidden beneath the front: antennæ of good size: eyes small, terminal on the long slender eyestalks: in the male only, one cheliped is enormously enlarged the other being very small ..... GELASIMUS.
- II. No pouch or opening between the bases of any of the legs:—
1. The antennules fold obliquely or nearly vertically: curious membranous spaces, or "tympana," are present on the meropodites of the legs (*Scopimerinæ*):—
    - i. Tympana very well defined: external maxillipeds very large and with a strong almost hemispherical bulge forwards:—
      - a. Merus of external maxillipeds larger than the ischium: the distal end of the 4th abdominal segment of the male is fringed with bristles and overlaps the 5th segment ..... DOTILLA.
      - b. Ischium of external maxillipeds larger than the merus: the 4th abdominal segment of the male is normal, but the 5th is constricted in part or all of its extent and gives the abdomen a wasp-like appearance ..... SCOPIMERA.

- ii. Tympana ill defined: external maxillipeds of moderate size, the merus larger than the ischium: the chelipeds of the female, though not so stout as those of the male, are stouter than the legs ..... TYMPANOMERUS.
2. The antennules fold obliquely or quite transversely: no "tympana" are present on any of the joints of the legs (*Macrophthalmi*):—
- i. Merus of the external maxillipeds smaller than the ischium, the flagellum coarse and articulating at the antero-external angle of the merus: front deflexed: eyestalks often very long ..... MACROPTHALMUS.
- ii. Merus of the external maxillipeds as large as or larger than the ischium, at least the two terminal joints of the flagellum are slender: eyestalks not particularly long:—
- a. Front declivous: carapace slightly convex: the flagellum of the external maxillipeds articulates at the antero-external angle of the merus: (the chelipeds of the female, as in all *Macrophthalmi*, are shorter and slenderer than the legs) ..... CLISTOTOMA.
- b. Front square-cut, not in the least deflexed; carapace quite flat dorsally: the flagellum of the external maxillipeds articulates near, but not at, the antero-external angle of the merus: eyes not terminal on the eyestalks ..... TYLODIPLAX.

## Subfamily OCYPODINÆ, Dana.

## OCYPODA, Fabr.

*Ocypoda*, Fabricius, Ent. Syst. Suppl. p. 347: Desmarest, Consid. Gen. Crust. p. 119, and Dict. Sci. Nat. XXVIII. p. 239: De Haan, Faun. Japon. Crust. p. 29: Milne Edwards, Hist. Nat. Crust. II. 41, and Ann. Sci. Nat., Zool., (3) XVIII. 1852 p. 141: Dana, U. S. Expl. Exp. Crust. pt. I. p. 324: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 179: Miers, Ann. Mag. Nat. Hist. (5) X. 1882, p. 376, and Challenger *Brachyura*, p. 237: Ortmann, Zool. Jahrb., Syst., X. 1897-98, p. 359 (*Revision der Gattung Ocypoda*).

Carapace deep, square or subquadrilateral, broader (but not much broader) than long, moderately convex, strongly declivous anteriorly, its dorsal surface closely granular with the regions indistinctly and incompletely defined. Front a narrow deflexed lobe, from a seventh to an eighth the greatest breadth of the carapace.

Orbits very capacious, occupying the whole face of the carapace between the front and the antero-lateral angles on either side, usually not very deep: their floor is divided into two fossæ, one for the basal portions of the eyestalk, the other for the eye. The basal joint of the eyestalk is visible throughout: the eye chiefly occupies the ventral surface of the eyestalk, and is often, but not always, tipped by a horn or style formed by a prolongation of the latter.

The basal antennular joint is visible, but the rudimentary antennular flagellum is quite hidden beneath the front. The antennæ, which lie in the orbital hiatus, are, though properly formed in all their parts, little more than rudiments.

The epistome, though short, is quite distinct, and is sculptured. The buccal cavern (in its widest part) is as broad as long, but diminishes in size a little, anteriorly: it is completely closed by the external maxillipeds, which are somewhat narrow and elongate and end in a coarse flagellum that articulates with the antero-external angle of the merus.

Chelipeds shorter than the legs and, in both sexes, remarkably unequal, the larger one being much more massive than the legs. The palm is short and high—especially in the larger cheliped—and is almost always compressed—especially so in the smaller cheliped: the fingers are stout, usually compressed, and strongly toothed. In most cases there is, on the inner surface of the larger palm, near the fingers, a stridulating organ, which can be scraped against the inner surface of the ischium.

Legs stout, the fourth pair much shorter and somewhat less massive than the first three pair, which are of about equal length: between the basal joints of the 2nd and 3rd pair is an orifice, thickly protected by hairs, leading towards the branchial cavity. The branchial cavity is very capacious, and its lining membrane is thick spongy and vascular.

The abdomen of the male is narrow: in both sexes it consists of seven separate segments.

*Distribution:* Tropical and subtropical coasts, from the American Atlantic, through the Mediterranean and Red Seas, to the American Pacific.

The *Ocypodes* live together in large companies, and most of them are in the habit of digging long and tortuous burrows in the moist sand near high-water mark, into which they retire with great rapidity when alarmed. As a rule they do not go far from their burrows, but if they do happen to wander and are cut off, they run to sea with marvellous speed. Though the burrows can be but temporary structures, each individual crab, in all the species that I have observed, keeps rigidly to its own. The efficacy of the stridulating-organ as a musical instrument is beyond

dispute, and I have published my own observations on that of *O. macrocera* in the Administration Report of the Marine Survey of India for the year 1891-92 (re-printed in the *Annals and Magazine of Natural History* for 1892). Dr. A. R. Anderson has published a note on the sound produced by *O. ceratophthalma* in this *Journal* for the year 1894.

My own opinion is that these crabs use the stridulating-organ when in their burrows—which undoubtedly are private property—to warn intending intruders of the herd that the burrow is occupied, and thus to prevent the burrow becoming crowded to suffocation-point. This, of course, need not be its exclusive use.

*Key to the Indian species of Ocypoda.*

- I. No stridulating ridge on the inner surface of the palm: eyestalks not prolonged beyond the eyes in the form of a style ..... *O. cordimana.*
- II. A stridulating ridge on the inner surface of the palm: eyestalks (except sometimes in the young) prolonged beyond the eyes to form a horn or style:—
  1. Length of the stridulating organ much more than half the greatest breadth of the palm: antero-lateral angles of the carapace well pronounced:—
    - i. Fingers of both chelipeds pointed:—
      - a. Stridulating ridge narrow, consisting entirely of small tubercles: no brushes of hairs on the propodites of any of the legs ..... *O. platytarsis.*
      - b. The stridulating ridge consists of tubercles gradually passing into striæ: the anterior surface of the propodites of the first two pairs of legs thickly furnished with hairs ... *O. ceratophthalma.*
    - ii. Fingers of the smaller cheliped expanded at tip: the stridulating ridge consists entirely of striæ... *O. macrocera.*
  2. Length of the stridulating organ much less than half the greatest breadth of the palm: antero-lateral angles of the carapace rounded off ..... *O. rotundata.*

The synonymy of the species of *Ocypoda* has been discussed, at length, by Ortmann (*Zool. Jahrb., Syst.*, X. 1897-98, p. 359), who has had access to a great deal more material than I have. It would be inadvisable, therefore, for me, working on a collection made almost entirely in India, to attempt any independent criticism of the older work; so that, in dealing with the Indian species, I shall generally restrict my citations to the papers of Ortmann and the other authors (Kingsley and Miers) who have made a revision of the genus.

43. *Ocypoda ceratophthalma* (Pallas), Ortm.

*Cancer ceratophthalmus*, Pallas, *Spicilegia Zool.* IX. p. 83, pl. v. figs. 7, 8.

*Cancer cursor*, Herbat, *Krabben*, I. ii. 74, pl. i. figs. 8, 9.

*Ocypoda ceratophthalma*, Fabricius, *Ent. Syst. Suppl.* p. 347: Milne Edwards, *Hist. Nat. Crust.* II. 48, and Cuvier *Règne An. Crust.* pl. 17: Kingsley, *Proc. Ac.*

Nat. Sci. Philad. 1880, p. 179: Miers, Ann. Mag. Nat. Hist. (5) X. 1882, pp. 378, 379: C. W. S. Aurivillius, Zur. Biol. Amphib. Decap., p. 17 (Mitg. K. Ges. Wiss. Upsala, 1893).

ORTMANN, ZOOL. JAHRB., SYST. X. 1897-98, pp. 360, 364 (*ubi synon.*).

Carapace square, its greatest breadth, which is about a tenth more than its greatest length, is at the acuminate antero-lateral angles, which coincide with the outer orbital angles and are right angles, or nearly so.

The borders of the carapace, with the exception of the posterior border, are elegantly beaded or serrulate, and the lateral borders in their anterior third are straight and parallel, or nearly so.

The cardiac region can be distinguished, and the anterior ends of the cervical groove are present on either side of the gastric region.

Upper border of orbit sinuous and a little oblique, so that the outer angle of the orbit is considerably behind the front: the lower border has an obscure notch near its middle, but there is *no gap at its outer angle*. The eyestalk is prolonged beyond the eye into a blunt-pointed style of variable length.

The lateral borders of the buccal cavern, though their general direction is slightly convergent anteriorly, have a distinct outward curve. The merus and ischium of the external maxillipeds have their exposed surface circumscribed by a raised row of granules, which is deficient only at the basal attachment of the ischium.

Chelipeds and legs scabrous, the asperities having in many places a tendency to a rugiform or squamiform arrangement, and almost forming serrations on the borders of some of the joints, and becoming spines or teeth on the lower borders of the arms and hands and at both angles of the wrist—especially at the inner angle where there is always at least one distinct spine.

The stridulating organ of the larger palm is of good length (much more than half the greatest breadth of the palm) and is some little distance from the immobile finger, a thick strip of hair intervening: in its upper half it consists of tubercles gradually passing to striæ, in its lower half it consists of a comb of fine regular and very close-set striæ. It plays against a polished ridge that runs across the upper part of the inner surface of the ischium.

The palms and fingers of both hands—but notably of the smaller hand—are compressed, and the fingers of both hands are *pointed*.

The first three pairs of legs have the merus broadened: they do not differ greatly in length, and the 2nd pair, which are slightly the longest, are about two-and-a-half times the greatest length of the carapace. The fourth (last) pair are a good deal shortened—reaching only a little

more than half-way along the propodite of the 3rd pair—and have a much narrower merus. In all the legs the dactylus is stout and fluted like a bayonet and has more or less of its anterior surface hairy: though somewhat laterally-compressed at base and gradually broadening and becoming dorso-ventrally compressed towards the tip, it may fairly be called styliform. The propodites of the first two pairs of legs have conspicuous brushes of hairs along their anterior surface.

In the Indian Museum are 84 specimens from all parts of the coasts of the mainland and islands of India. Large specimens have the carapace 40 millim. long and about 45 millim. in greatest breadth.

*Distribution:* Indo-Pacific, from the east coast of Africa to the Sandwich Islands.

In young specimens the surface of the appendages is smoother and the eyestalks are not prolonged beyond the eyes, which are of large size. In half-grown specimens the terminal style of the eyes is still short.

#### 44. *Ocypoda macrocera*, Edw.

*Ocypoda macrocera*, Milne Edwards, Hist. Nat. Crust. II. 49: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 181: Miers, Ann. Mag. Nat. Hist. (5) X. 1882, pp. 378, 381: ORTMANN, ZOOL. JAHRB., SYST., X. 1897-98, pp. 360, 368.

Closely related to *O. ceratophthalma*, from which it is distinguished by the following characters:—

(1) the carapace is rather broader and the orbits are a little more oblique:

(2) the raised marginal row of granules on the external maxilliped is less pronounced:

(3) the fingers of the smaller cheliped are lamellar up to the tips, which are broad and blunt, not pointed:

(4) the stridulating ridge is less hairy and consists entirely of striæ.

(5) it is a smaller species, large specimens having the carapace 31 millim. long and 37 millim. broad.

In the Indian Museum are 78 specimens from the coasts of the Bay of Bengal: there are none from the west coast or from any of the islands, and the species appears to be confined to the Bay.

The colour, in life, is bright red. This species lives in large warrens in the sands of almost all parts of the east coast of the peninsula. One of its most active enemies is the Brahminy kite (*Haliastur indus*). One almost certain use of the stridulating-organ is to give warning to intending trespassers, of its own species, that a burrow is already occupied by its rightful owner.

45. *Ocypoda platytarsis*, Edw.

*Ocypoda platytarsis*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 141: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 180: Miers, Ann. Mag. Nat. Hist. (5) X. 1882, pp. 378, 383: ORTMANN, Zool. Jahrb., Syst., X. 1897-98, pp. 359, 363 (*ubi synonym.*).

This species may be distinguished from *O. ceratophthalma*, which it closely resembles, by the following characters:—

(1) the carapace is very distinctly broader, its length being about four-fifths of its breadth, and the orbits are hardly at all oblique:

(2) the surface of the ischium of the external maxillipeds is often quite smooth:

(3) the stridulating ridge is not, or hardly at all, hairy and consists entirely of granules or small mamillated tubercles; and though the upper edge of the inner surface of the ischium of the larger cheliped is raised and rough, there is no special process against which the stridulating-ridge of the palm can be scraped:

(4) the dactyli of the legs, though fluted as in the other species, are distinctly compressed dorso-ventrally and broadened:

(5) there are no brushes of hairs along the anterior surface of the propodites of any of the legs.

It is a somewhat larger species, the carapace in full-sized adults being 40 millim. long and 54 millim. broad.

In the Indian Museum there are 42 specimens from both coasts of the peninsula and from Ceylon.

46. *Ocypoda rotundata*, Miers.

*Ocypoda rotundata*, Miers, Ann. Mag. Nat. Hist. (5) X. 1882, pp. 378, 382: Ortmann, Zool. Jahrb., Syst., X. 1897-98, pp. 360, 364.

This species differs from *O. ceratophthalma* in the following important particulars:—

The carapace is less distinctly quadrilateral, owing to the fact that the antero-lateral borders are arched, instead of forming an angle with the upper border of the orbit. These borders sometimes form an unbroken curve with the upper border of the orbit, but sometimes the junction between the two is marked by a notch. The length of the carapace is about five-sixths its greatest breadth, which, owing to the curvature of the antero-lateral borders, is some distance behind the orbits.

There is a notch in the middle of the lower border of the orbit, and a gap at the outer angle, between the upper and lower borders.

The deflexed tip of the front is swollen.

The spines or serrations at the inner angle of the wrist are more numerous, and at the outer angle are better marked.



The length of the stridulating organ is much less than half the greatest height of the palm: the organ consists of about a dozen distant ridges much concealed in hair, and each ridge is sharply serrated.

The scraper on the ischium is placed near the upper angle of the inner face of that joint and consists of an elongate-elliptical longitudinally-grooved cicatrix-like surface, with a patch of hair above it and a much larger patch below it.

The fingers of the smaller cheliped are almost as much dilated at tip as those of *O. macrocera*.

The dactyli of the legs are dorso-ventrally compressed as in *O. platytarsis*.

There is a thick brush of hairs along the anterior surface of the propodite of the first pair of legs only.

The meropodites of the first three pairs of legs are not so broad as in the three preceding species.

In the Indian Museum are 29 specimens from the coasts of Catch, Sind, and Buluchistan.

This is the largest Indian Ocypode, the carapace of the adult being 52 millim. long and 62 millim. broad.

#### 47. *Ocypoda cordimana*, Desm.

*Ocypoda cordimana*, Desmarest, Consid. Gen. Crust. p. 121: Milne Edwards, Hist. Nat. Crust. II. 45: Kingsley, Proc. Ac. Nat. Sci. Philad., 1880, p. 185: de Man, Notes Leyden Mus., III. 1881, p. 248: Miers, Ann. Mag. Nat. Hist. (5) X. 1882, pp. 379, 387: ORTMANN, ZOOL. JAHRB., SYST., X. 1897-98, pp. 359, 362 (*ubi synon.*).

Carapace deep, quadrilateral, strongly convex fore and aft, its length about seven-eighths its greatest breadth, which is some little distance behind the orbits, owing to the gentle curve of the antero-lateral borders: its antero-lateral angles coincide with the outer orbital angles, and point acutely forwards.

Orbits deep; their upper border sinuous, but not in the least oblique; there is usually a notch near the middle of their lower border, and always a deep gap at the outer angle. No terminal style to the eyes.

The lateral borders of the buccal cavern are anteriorly convergent and have no outward curve. The marginal row of granules on the outer surface of the ischium of the external maxillipeds is indistinct or absent.

Though the chelipeds and legs are rough and the roughness is in places squamiform, there is no serration of their edges, except in the case of the lower borders of the arms, the inner edge of the wrists, and the lower border of the hands. The palm of the larger hand, though deep, is not particularly compressed, and it has no stridulating ridge.

The propodites and dactyli of the legs are rather short and stout, the dactyli being fluted and more or less hairy: the edges of the propodites of the first 2 pairs of legs are hairy. The third pair of legs, which are slightly longer than the first 2 pairs, are less than twice the length of the carapace.

In the Indian Museum are 59 specimens, from the Laccadives, the Madras coast, Ceylon, Mergui, Tavoy, the Andamans and Nicobars.

The carapace of the largest specimen is 35 millim. long and 40 millim. broad.

#### GELASIMUS, Latr.

*Gelasimus*, Latreille, Dict. des Sciences Nat. XVIII. p. 286 (1820): Desmarest, Consid. Gen. Crust. p. 122, and Dict. Sci. Nat. XXVIII. p. 241: De Haan, Faun. Japon. Crust. p. 25: Milne Edwards, Hist. Nat. Crust. II. 49, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 114: Dana, U. S. Expl. Exp. Crust. pt. I, pp. 312, 315: Hess, Archiv f. Naturges. XXXI. 1865, p. 145: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 271: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 135, 136: Miers, Challenger Brachyura, p. 241: de Man, Notes. Leyden. Mus. XIII. 1891, pp. 20-23: Ortman, Zool. Jahrb., Syst. VII. 1893-94, pp. 749-753.

"*Uca*," Leach, Trans. Linn. Soc. XI. 1815, pp. 309, 323: M. J. Rathbun, Proc. Biol. Soc. Washington, XI. 1897, p. 154: Ortman, Zool. Jahrb., Syst., 1897-98, p. 346 (cf. notes by Desmarest and Milne Edwards, *l. cc. supra*).

In obedience to certain interpretations of the rule of priority, which sacrifice everything to a legal precision that defeats the object of classification, some modern authors propose to apply the name *Uca*, which was originally given to and has for nearly seventy-five years been authoritatively used for a land-crab of the Gecarcinoid family, to the species of the Ocypodoid family which have for the same long period been known to everybody by the name *Gelasimus*.

One of the objects of my poor work being to avoid confusion, I cannot consent to this proposal: and if the rules of nomenclature do not permit me to retain a name that has been deliberately chosen, and used without any ambiguity, by such illustrious predecessors as Latreille, Milne Edwards, and Dana, then I think that the rules should be modified.

The introduction of a rule sanctioning the retention of any name that has been accepted and defined by a monographer of repute, and that has thereafter been in common use for fifty years, would probably satisfy those to whom the written authority of the law is a consideration of first importance.

Carapace deep, subquadrilateral but with the antero-lateral angles produced and acute and the lateral borders more or less convergent posteriorly, occasionally subhexagonal, a good deal broader than long, the regions never very strongly defined. The front is a narrow declivous lobe, the breadth of which, between the eyestalks, is from one-sixteenth to one-sixth the greatest breadth of the carapace.

The orbits are narrowish trenches occupying the whole anterior extent of the carapace between the narrow front and the antero-lateral

angles, and are more or less sinuous and oblique: the eyestalks are very long and are formed as in *Ocypoda*, but are much slenderer: the eyes, though chiefly ventral in aspect, are always terminal.

The small antennular flagella, which are not hidden under the front, fold obliquely. The antennæ, which stand free at the inner angle of the orbits, have well developed flagella.

Epistome, though short, quite distinct. The lateral borders of the buccal cavern are convex outwards, sometimes so much so as to give the cavern a subcircular outline. The external maxillipeds have a long ischium and a short and somewhat oblique merus with the coarse flagellum jointed to its antero-external angle: they close the buccal cavern except for a chink anteriorly.

The chelipeds differ greatly in the sexes. In the female they are equal, are shorter and slenderer than the legs, and have broad-tipped spoon-shaped fingers. In the male one of the chelipeds resembles those of the female, but the other is of relatively gigantic proportions, the hand alone being often as big and heavy as all the rest of the animal.

The legs are stout and end in very sharp dactyli, and the meropodites of at least the 2nd and 3rd pairs are foliaceous: these two pairs are a little longer than the other two, being about twice the length of the carapace.

As in *Ocypoda*, the branchial cavity is capacious, and its living membrane thickened and vascular, with a fleshy lobe, shaped like a gill-plume, projecting into the space between the tips of the last two gill-plumes: also, between the basal joints of the 2nd and 3rd pairs of legs, there is an orifice, thickly protected by hairs, leading towards the branchial cavity.

The abdomen of the male is narrow: in both sexes of all the Indian species it consists of seven separate segments.

*Distribution*: all the warmer regions of the globe, from the Atlantic coasts of America eastwards (including the Mediterranean basin) to the Pacific coasts of America again.

The species of *Gelasimus* are, like the *Ocypodes*, gregarious, and live in warrens in the mud-flats of tropical and subtropical estuaries. Their intelligence, like that of the *Ocypodes*, is of a high order.

In one species, at any rate (*Gelasimus annulipes*), the males, which are greatly in excess of the females, use the big and beautifully-coloured cheliped, not only for fighting with each other, but also for "calling" the females. I have described my own observations on these points in the *Administration Report of the Marine Survey of India for 1891-92*—reprinted, as an extract, in the *Annals and Magazines of Natural History for 1892*.

The fact that the males greatly outnumber, and therefore are more

commonly captured than, the females, is sufficient justification for the common practice of using the larger cheliped of the male for the discrimination of the species. It must, however, be remembered that—at least in all the Indian species—this organ changes greatly with advancing age.

I must also confess here that the synonymy of species has defied me.

*Key to the Indian species of Gelasimus.*

- I. The breadth of the front, measured exactly between the bases of the eyestalks, is between a fifth and a sixth the greatest breadth of the carapace :—
  1. Two oblique granular ridges on the inner surface of the palm of the large cheliped of the male, one continuous with the dentary edge of the immobile finger, the other running to the lower edge of the same finger :—
    - i. Carapace subquadrilateral, the true lateral borders being moderately convergent posteriorly : an enlarged tooth near the tip of the immobile finger of the large cheliped of the male gives the tip of this finger a notched-truncate appearance *G. annulipes.*
    - ii. Carapace subquadrilateral, the true lateral borders nearly parallel : the tip of the immobile finger of the large cheliped of the male is oblique-truncate but not notched *G. lacteus.*
    - iii. Carapace distinctly hexagonal, owing to the great obliquity of the orbits and the strong convergence posteriorly of the true lateral borders : tip of the immobile finger of the large cheliped of the male not truncate or notched *G. triangularis.*
  2. The oblique crest running to the lower edge of the immobile finger of the large cheliped of the male is either absent or is represented by a slight and smooth tumescence *G. inversus.*
- II. The breadth of the front, measured as above, is very much less than a sixth the greatest breadth of the carapace :—
  1. No row of granules running inside of and parallel with the lower border of the orbit :—
    - i. The inner border of the arm of the larger cheliped of the male ends in a sharp tooth or spine, independent of the terminal lobe-like constriction of the arm :—
      - a. Front, measured as above, about a tenth the greatest breadth of the carapace : in the large cheliped of the male the wrist is

- smooth, the palm full with the granular ridges on the inner surface indistinct, and the fingers are not specially compressed... *G. tetragonum.*
- b. Front, measured as above, not a fifteenth the greatest breadth of the carapace: in the large male cheliped the upper surface of the wrist is granular and the fingers are remarkably compressed and blade-like:—
- a. In the large male cheliped the crests on the inner surface of the palm are moderately prominent, the dactylus is quite blade-like and the cutting-edge of the immobile finger is not much scalloped ..... *G. Marionis.*
- β. The crests on the inner surface of the palm are extremely prominent, the cutting edge of the dactylus is not quite straight and that of the immobile finger is scalloped into two large triangular lobes ..... *G. Marionis, var. nitidus.*
- ii. The arm of the large male cheliped ends in a constricted lobe, but there is no sharp upstanding tooth inside it on the inner border:—
- a. Front, measured as above, about a twelfth the greatest breadth of the carapace; the fingers of the large male cheliped have tips that suggest tongs, owing to the presence of an enlarged tooth near the tip: the meropodites of the last pair of legs are nearly as foliaceous as those of the preceding pair ..... *G. acutus.*
- b. Front, measured as above, not a fifteenth the greatest breadth of the carapace: the fingers of the large male cheliped end in simple hooked tips: the meropodites of the last pair of legs are not much broadened ..... *G. Dussumieri.*
2. On the lower wall of the orbit, inside of and parallel with the middle third of the lower border of that cavity, is a raised row of granules ..... *G. Urvillei.*

48. *Gelasimus annulipes*, Latr., Edw.

? *Cancer vocans minor*, Herbst, Krabben, I. ii. 81, pl. i. fig. 10.

*Gelasimus annulipes*, Milne Edwards, Hist. Nat. Crust. II. 55, pl. xviii. fig. 10-13; and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 149, pl. iv. fig. 15: Dana, U. S. Expl. Exp. Crust., pt. I. p. 317: Heller, Novara Crust. p. 32: Hilgendorf, in v. d. Decken's Reis. Ost-Afr. III. i. p. 85, and MB. Ak. Berl. 1878, p. 303: Hoffmann, in Pöllen and van Dam, Faun. Madagasc., Crust. p. 18: Kossmann, Reise roth.

Meer., Crust., p. 53: Miers, Phil. Trans. Roy. Soc. Vol. 168, 1879, p. 488, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 310, and Zool. H. M. S. Alert, pp. 518, 541, and Challenger Brachyura, p. 244: Richters, in Möbius Meeresf. Maurit., p. 155: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 148, pl. x. fig. 22: de Man, Notes Leyden Mus. II. 1880, p. 69, and Journ. Linn. Soc., Zool., XXII. 1887-88, p. 118 pl. viii. fig. 5-7, and Archiv f. Naturges. LIII. 1887, i. p. 353, and Notes Leyden Mus. XIII. 1891, pp. 23, 39, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 307, and Zool. Zahrb., Syst., VIII. 1894-95, p. 577: Lenz & Richters, Abh. Senck. Nat. Ges. Frankf., XII. 1881, p. 423: F. Müller, Verh. Ges. Basel. VIII. 1886, p. 475: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 388: Ortman, Zool. Jahrb. Syst. VII. 1893-94, pp. 752, 753, and Jena. Denk. VIII. 1894, p. 57: Zehntner, Rev. Suisse de Zool. II. 1894, p. 178.

*Gelasimus Carionis*, Edw. (*nec* Desm.), Hist. Nat. Crust. II. 53.

*Gelasimus porcellanus*, White, P. Z. S. 1847, p. 85, and in Adams and White, Samarang Crust., p. 50: Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 151: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 155.

*Gelasimus perplexus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 150, pl. iv. fig. 18: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 274.

? *Gelasimus pulchellus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, pp. 99, 100.

*Uca annulipes*, Ortman, Zool. Jahrb. Syst. X. 1897-98, pp. 351 and 354: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 274: Doflein, SB. Ak. Münch. XXIX. 1899, p. 193.

Length of the carapace about three-fifths of the greatest breadth at the acute claw-like antero-lateral angles. The posterior border of the dorsum of the carapace—*i.e.*, the border corresponding with the last segment of the sternum—is a good deal over half the greatest breadth of the carapace, so that the lateral borders of the dorsum of the carapace, which are distinctly defined in almost two-thirds of their extent by a fine raised line, are only moderately convergent. The post-gastric and cardiac regions are the only ones that are defined, and they but faintly.

Front, measured between the bases of the eyestalks, from a fifth to a sixth the greatest breadth of the carapace.

Orbits sinuous and considerably oblique; their upper border defined by a fine raised line which is very distinctly double in a good part of its extent; their lower border very elegantly and regularly serrated—the teeth increasing in size from within outwards. In the female only there is a short row of granules inside of and parallel with the lower border of the orbit.

In the large cheliped of the adult male the greatest length of the hand (including fingers) is at least three times the length of the carapace: the outer surface of the somewhat rounded arm and of the wrist and hand is smooth to the naked eye, with a few small granules on the inner border of the wrist: the lower border of the palm is obscurely marginate: and on the inner surface of the palm are two salient granular crests, one of these is deeply grooved and nearly vertical and becomes continuous with the dentary edge of the immobile finger, the other,

which is the more prominent, is oblique and runs to the lower border of the same finger. In the adult male the fingers of the large hand are about twice the length of the upper border of the palm: they are not very broad, and owing to the hook-like curve of the dactylus there is a wide space between them when the tips are apposed: the immobile finger is but slightly curved, and is generally shorter than the dactylus, and owing to the presence of an enlarged tooth near the tip, the tip has a characteristic notched-truncate appearance.

The meropodite in the last pair of legs is not at all foliaceous.

The carapace in the adult male is about 11 millim. long and 19 millim. broad.

In the Indian Museum are 300 specimens from all parts of the coast from Karachi on the west to Mergui on the east.

This species is not, as Miers queries, the same as Stimpson's *G. splendidus*, of which we have numerous specimens from Hongkong.

#### 49. *Gelasimus lacteus* (De Haan).

*Ocypode* (*Gelasimus*) *lactea*, De Haan, Faun. Japon., Crust., p. 54, pl. xv. fig. 5.

*Gelasimus lacteus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, pl. iv. fig. 16: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 100: Miers, P. Z. S. 1879, pp. 20, 36: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 149, pl. x. fig. 23: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 234: de Man, Notes Leyden Mus. XIII. 1891, p. 22: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, pp. 752, 759.

*Uca lactea*, Ortmann, Zool. Jahrb., Syst., X. 1897-98, pp. 351, 355.

Easily distinguished from *G. annulipes*, which is its nearest relative, by the following characters:—

(1) the carapace is much more nearly quadrangular, the posterior border of its dorsum being between three-fifths and two-thirds of its greatest breadth, and its true lateral borders being parallel, while the lateral borders of its dorsum are nearly so:

(2) in the larger cheliped of the male the outer end of the upper border of the arm, and the inner border of the wrist, are distinctly denticulated; the dactylus is not so strongly hooked, and the end of the immobile finger though obliquely truncate has an acuminate tip—never a notched-truncate tip:

(3) the colour, in spirit specimens, has a sort of livid bloom never seen in *G. annulipes*.

In the Indian Museum are 47 specimens from Karachi and 3 from the Andamans.

#### [*Gelasimus inversus*, Hoffmann.

*Gelasimus inversus*, Hoffmann, in Pollen and van Dam, Faun. Madagasc. Crust. p. 19, pl. iv. figs. 23-26 (1874): Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 155.

de Man, *Notes Leyden Mus.* XIII. 1891, pp. 21, 44, pl. iv. fig. 12; Ortmann, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 751, and *Jena. Denk.* VIII. 1894, p. 69.

*Galasimus chlorophthalmus*, Hilgendorf (*nec* Edw.), *MB. Ak. Berl.* 1878, p. 803 (*apud* de Man).

*Gelasimus Smithii*, Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, p. 144, pl. 9, fig. 14 (*apud* Ortmann).

*Uca inversa*, Ortmann, *Zool. Jahrb., Syst.*, X. 1897-98, p. 351.

There are in the Indian Museum specimens of this species from Madagascar and the Red Sea, and some from Karachi which differ from the type in the form of the dactylus of the large male cheliped, and are here separated as a variety.]

50. *Gelasimus inversus*, var. *sindensis*, nov.

This variety differs from typical *G. inversus* from Madagascar only in having the tip of the dactylus of the large male cheliped simple (instead of furnished with a second tooth that gives it a notched appearance) and the palm of the hand smoother externally.

The species resembles *G. annulipes*, from which it differs in the following characters:—

(1) the lateral borders of the dorsum of the carapace are defined by a fine line which is raised and distinct in the anterior third only, and is a little more oblique:

(2) the lower border of the orbit is much more sinuous, and is either entire or is quite imperceptibly denticulated at its outer angle:

(3) in the large cheliped of the male the arm is trigonal with sharp edges, the upper edge rising into a distinct lobe or crest and the distal end of the inner edge forming a crest or blunt tooth; the inner edge of the wrist is distinctly denticulated, and the upper border of the palm has several longitudinal rows of granules; of the granular ridges on the inner surface of the palm the lower one that in *G. annulipes* runs to the lower edge of the immobile finger is absent or, at most, is represented by a smooth and slight swelling; finally the immobile finger, though as in *G. annulipes* nearly straight and shorter than the dactylus, has a simple not a notch-like tip.

In the Indian Museum are 30 specimens from Karachi. The carapace of the largest specimen is 10 millim. long and 18 millim. broad.

51. *Gelasimus triangularis*, A. M. Edw.

*Gelasimus triangularis*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 275; Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, p. 150; de Man, *Journ. Linn. Soc., Zool.*, XXII. 1887-88, p. 119, pl. viii. figs. 8-11, and *Notes Leyden Mus.* XIII. 1891, p. 22, and in *Weber's Zool. Ergebn. Niederl. Ost. Ind.* II. 1892, p. 307; and *Zool. Jahrb., Syst.*, VIII. 1894-95, p. 577; J. R. Henderson, *Trans. Linn. Soc., Zool.*, (2) V. 1893, p. 388.



*Gelasimus perplexus*, Heller (nec Edw.), *Novara Crust.* p. 88, pl. v. fig. 4.

?? *Gelasimus minor*, Owen, *Zool. H. M. S. "Blossom," Crust.*, p. 79, pl. xxiv. figs. 2, 3a (1839): Milne Edwards, *Ann. Sci. Nat., Zool.*, XVIII. 1852, p. 151: Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, p. 150.

*Uca triangularis*, Nobili, *Ann. Mus. Genov.* (2) XX. 1899, p. 274.

Length of the carapace about four-sevenths of the greatest breadth, which is at the spine-like antero-lateral angles.

Carapace strongly convex, almost hexagonal, the regions not indicated. The posterior border of the dorsum of the carapace is less than half the greatest breadth, hence not only the lateral borders of the dorsum of the carapace, but also the true lateral borders, are strongly convergent posteriorly, the former being defined by a fine raised line in more than two-thirds of their extent.

Front, as in *G. annulipes*, from a fifth to a sixth the greatest breadth of the carapace.

Orbits sinuous, much oblique: the upper border defined by a fine microscopically-beaded line, which is double in great part; the lower microscopically beaded, serrulate at its outer end.

In the large cheliped of the adult male the hand is about  $2\frac{1}{2}$  times as long as the carapace; the outer surface of the arm, wrist, and hand are smooth to the naked eye; all the borders of the arm are sharply defined and finely serrulate, the inner border of the wrist is finely serrulate, and the upper and lower borders of the palm are marginate and granulate, especially the upper border; and the two oblique granular crests on the inner surface of the arm are in strong relief.

In the large hand the dactylus, in the adult, is from  $1\frac{1}{2}$  to  $1\frac{3}{4}$  times the length of the upper border of the palm; its tip is simply hooked and overhangs the simple upcurved tip of the immobile finger.

The meropodite of the last pair of legs is not nearly so broad as that of the two preceding pairs.

In the Indian Museum are 70 specimens, all but one being from various parts of the Bay of Bengal littoral. The carapace of a large specimen is 10 millim. long and about 18 millim. broad.

The figures of *G. minor*, Owen, agree very well with this species, and if the two names should prove to refer to the same species this name has the precedence.

## 52. *Gelasimus tetragonum* (Herbst).\*

*Cancer marinus, minor, vociferans*, Seba, *Thesaurus*, III. p. 48, pl. xix. fig. 15.

*Cancer tetragonon*, Herbst, *Krabben*, I. ii. 267, pl. xx. fig. 110, and III. i. 81.

*Gelasimus tetragonum*, Rüppell, *24 Krab. roth. Meer.*, p. 25, pl. v. fig. 5: Milne

\* I assume that Herbst used *tetragonon* as a noun substantive in apposition to *Cancer*: it may therefore continue in apposition to *Gelasimus* used as a substantive.

Edwards, *Hist. Nat. Crust.* II. 52, and *Ann. Sci. Nat., Zool.*, (3) XVIII. 1853, p. 147, pl. iii. fig. 9: Guérin, *Voy. Coquille*, II. *Zool., Crust.* p. 10, pl. i. figs. 2, 3: A. Milne Edwards, in *Maillard's l'île Réunion*, *Ann. F.*, p. 6, and *Nouv. Archiv. du Mus.* IX. 1873, p. 273: Heller, *Novara Crust.*, p. 37: Hilgendorf, in v. d. Decken's *Reisen Ost-Afr. Crust.* p. 84: Hoffmann, in *Pollen and Van Dam, Faun. Madag. Crust.* p. 16: Kossmann, *Reis. roth. Meer. Crust.* p. 52: Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1890, p. 143, pl. ix. fig. 11: de Man, *Archiv f. Naturges.* LIII. 1887, i. p. 353, and *Notes Leyden Mus.* XIII. 1891, pp. 20, 24, pl. ii. fig. 6: Ortmann, *Zool. Jahrb. Syst.* VII. 1893-94, pp. 750, 754: Whitelegge, *Mem. Austral. Mus.* III. 1897, p. 138.

*Gelasimus Duperreyi*, Guérin, *Dana U. S. Expl. Exp. Crust.* pt. i. p. 317.

*Uca tetragona*, Ortmann, *Zool. Jahrb., Syst.* X. 1897-98, p. 348: Doflein *SB. Ak. Münch.* XXIX. 1899, p. 193.

Length of the carapace about two-thirds of its greatest breadth at the acute antero-lateral angles. Carapace somewhat pentagonal, markedly convex fore and aft, the regions all recognizable but not strongly defined: though the posterior border of its dorsum is only half its greatest breadth, the true lateral borders are but slightly convergent posteriorly. In the adult male the fine raised line that bounds the dorsal plane on each side is distinct as such only in the neighbourhood of the antero-lateral angles, but in the female it runs much further backwards.

The breadth of the front, measured between the bases of the eyestalks, is about a tenth the greatest breadth of the carapace.

Orbits much oblique, both borders sinuous, the lower border elegantly denticulated throughout.

In the large cheliped of the adult male the upper border of the arm is fairly prominent and the inner border ends in a sharp tooth, quite independent of the constricted-off terminal lobule; the wrist is quite smooth to the naked eye, and has the inner angle sharp but not spiniform; and the hand is about  $2\frac{1}{2}$  times the greatest length of the carapace.

In the hand of this cheliped the palm is, to the naked eye, frosted with very fine granules, some of which in the neighbourhood of a scar near the base of the immobile finger are visible to the naked eye; its upper border is not, and its lower border is but obscurely, defined; and the two oblique crests on its inner surface are mere swellings, often quite faint, and never strongly salient. The fingers are neither broad nor particularly thin: the dactylus, which is about  $1\frac{1}{3}$  times the length of the upper border of the palm, tapers and is somewhat hooked at tip; the immobile finger commonly has two teeth a little enlarged, the second one being near the tip and sometimes giving the tip a somewhat notched (but not truncated) appearance.

The merus of the last pair of legs is not at all foliaceous.

In the Indian Museum are 29 specimens from the Andamans: the carapace of a large one is 17 millim. long and 26 millim. broad.

The "Challenger" specimens referred by Miers to this species have a broad front and are identical with specimens from Hongkong that I take to be *G. splendidus*.

### 53. *Gelasimus Marionis*, Desm.

*Gelasimus Marionis*, Desmarest, Consid. Gen. Crust., p. 124, pl. xiii. fig. 1, and Dict. Sci. Nat. XXVIII. 1823, p. 248: Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 145, pl. iii. fig. 5 (*nec* Hist. Nat. Crust. II. 53): de Man, Notes Leyden Mus. II. 1890, p. 67: Miers, Ann. Mag. Nat. Hist. (5) V. 1890, p. 303: Kingsley, Proc. Ac. Nat. Sci. Philad. XXXII. 1880, p. 141, pl. ix. fig. 8.

*Gelasimus cultrimanus*, White, P. Z. S. 1847, p. 205, Ann. Mag. Nat. Hist. XX. 1847, p. 205, and Samarang Crust. p. 49 (*apud* Miers *loc. cit. supra*).

*Gelasimus cultrimanus* var. *Marionis*, Ortmann, Zool. Jahrb. Syst. VII. 1893-94, pp. 750, 754.

Length of the carapace about two-thirds of the greatest breadth, which is at the claw-like antero-lateral angles.

Carapace little convex, all its regions very well defined, the posterior border of its dorsum in the adult male is half its greatest breadth and the true lateral borders are moderately convergent posteriorly: the fine raised line that in some other species defines the greater part of the dorsal plane is here, in the adult male, confined to the neighbourhood of the antero-lateral angles.

The breadth of the front between the bases of the eyestalks is not a fifteenth the greatest breadth of the carapace.

Orbits not very oblique nor very sinuous; the lower border, which is nearly straight, is elegantly crenulate throughout.

In the large cheliped of the adult male the upper border of the arm is prominent and the inner border ends in a sharp tooth, independent of the terminal constricted-off lobule; the upper surface of the wrist is granular, and the inner border of the wrist has a denticle or spinule at its angle; and the hand (fingers included) is about three times the length of the carapace.

This large hand has a curious twist: its palm is compressed and has the upper and lower margins well defined, the outer surface covered with large granules, and the two granular crests on its inner surface fairly prominent: its fingers are broad thin and laminar; the dactylus, which may be four times as long as the upper border of the palm, is shaped like a knife-blade; and in the immobile finger, which has a groove or line of pits along its outer surface, the dentary edge has a simple S-shaped curve.

The merus of the last pair of legs is not at all foliaceous.

In the Indian Museum are 9 specimens from the Andamans. The carapace of a large specimen is 18.5 millim. long and 26.5 millim. broad.

54. *Gelasimus Marionis* var. *nitidus*, Dana.

*Gelasimus vocans*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 145, pl. iii. fig. 4 (nec Hist. Nat. Crust. II. 54): Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 99: Heller, Novara Crust. p. 37: Hilgendorf, in v. d. Decken's Reis. Ost-Afr., p. 83: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 272: Hoffmann, in Pollen and Van Dam's Fann. Madagasc. Crust. p. 16: Miers, Phil. Trans. Roy. Soc. Vol. 168, 1879, p. 488, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 308, and Challenger Brachynra, p. 242: Richters, in Mobius, Meeresf. Maurit. p. 155: de Man, Notes Leyden Mus. II. 1880, p. 67, and XIII. 1891, p. 23, pl. ii. fig. 5, and Archiv f. Naturges. LIII, 1887, i. p. 352, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 305, and Zool. Jahrb. Syst. VIII. 1894-95, p. 572: Haswell, Cat. Austral. Crust. p. 92.

*Gelasimus nitidus*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 316, pl. xix. figs. 5a-d: Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 147: Thallwitz, Abh. Mus. Dresden, 1890-91, p. 42.

*Gelasimus cultrimanus*, Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 140, pl. ix. fig. 7: Ortman, Zool. Jahrb., Syst., VII. 1893-94, pp. 750-753, and Jena. Denk. VIII. 1894, p. 56.

*Uca cultrimana*, Ortman, Zool. Jahrb., Syst. X. 1897-98, p. 348.

Differs from *G. Marionis* only in the form of the large hand of the adult male: this member, in var. *nitidus*,

(1) is not much over  $2\frac{1}{2}$  times the length of the carapace, its dactylus being but little more than twice the length of the upper border of the palm:

(2) it has the two oblique granular ridges on the inner surface of the palm remarkably salient:

(3) it has the dentary edge of the immobile finger thrown into a characteristic W-shaped curve owing to the strong projection of two large triangular lobes, and

(4) it has the dactylus somewhat hooked at tip.

In the Indian Museum are 103 specimens, chiefly from the Andamans and Nicobars, but also from the Coromandel and Malabar coasts. The length of the carapace in large specimens is 14 millim., the breadth 21 millim.

55. *Gelasimus acutus*, Stimpson, de Man.

*Gelasimus acutus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 99: Tozzetti, Magenta Crust. p. 107: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 144: de Man, Journ. Linn. Soc., Zool. XXII. 1887-88, p. 113, pl. vii. figs. 8-9, pl. viii. figs. 1-4, and Notes Leyden Mus. XIII. 1891, p. 21, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 306, and Zool. Jahrb. Syst. VIII. 1894-95, p. 573: Ortman, Zool. Jahrb., Syst. 1893-94, p. 750.

*Uca acuta*, Doflein, SB. Ak. Münch. XXIX. 1899, p. 193.

Length of the carapace about three-fifths the greatest breadth, which is at the acute wing-like antero-lateral angles.

Carapace strongly convex fore and aft, the regions moderately well defined: its lateral borders are strongly convergent, and still more so are the lateral borders of the dorsal plane, which are defined in more than two-thirds of their extent by a fine raised line: the posterior border of the dorsal plane is contained from  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in the greatest breadth.

Front, measured between the eye-stalks, about a twelfth the greatest breadth of the carapace, its moulded and bevelled edges do not together take up half its breadth.

Orbits moderately oblique, both upper and lower borders much sinuous; the lower border finely, the upper border still more finely and more distantly crenulate.

In the large cheliped of the adult male all three borders of the arm are well defined, the inner and the lower borders being crenulated, but the inner border having no tooth independent of the terminal constricted-off lobule; the upper surface of the wrist and the outer surface of the palm are closely covered with vesiculous granules; and the hand (fingers included) may be  $3\frac{1}{2}$  times the length of the carapace.

In this large hand the upper and lower borders of the palm are well defined, and of the two oblique granular crests on the inner surface of the palm the upper one that runs to the dentary edge of the immobile finger is short and indistinct: the fingers are not particularly broad or thin, and however the teeth may be disposed, there is always one near the end of each finger that is enlarged so as to give the ends of the fingers, when apposed, a sort of tongs-like or forceps-like grip: the dactylus is from 2 to nearly  $2\frac{3}{4}$  times the length of the upper border of the palm.

The merus of the last pair of legs is distinctly foliaceous.

In the Indian Museum are 92 specimens chiefly from the Sunderbunds and Mergui, but also from Karachi and the Andamans. In a large specimen the carapace is 14 millim. long and 25 broad.

#### 56. *Gelasimus Dussumieri*, Edw.

*Gelasimus Dussumieri*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 148, pl. iv. fig. 12: A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71, and IX. 1873, p. 274: Hoffmann in Pollen and van Dam's Faun. Madag. Crust. p. 17, pl. iii. figs. 19-22: Kingsley, Proc. Ac. Nat. Sci. Philad. 1890, p. 145, pl. x. fig. 16: de Man, Notes Leyden Mus. II. 1880, p. 68, and XIII. 1891, pp. 20, 26, and Journ. Linn. Soc. Zool. XXII. 1887-88, p. 108, pl. vii. figs. 2-7, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 306, and Zool. Jahrb., Syst., VIII. 1894-95, p. 576: Lenz and Richters, Abh. Senck. Nat. Ges. Frankf. XII. 1881, p. 423: Haswell, Cat. Austral. Crust. p. 93: Miers, Zool. H. M. S. Alert, pp. 518, 541: Ortmann, Zool. Jahrb. Syst. VII. 1893-04, pp. 750, 755.

*Gelasimus longidigitum*, Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 144, pl. ix. figs. 10, 13 (*vide* Ortmann *l. c. infra*).

*Uca Dussumieri*, Ortmann, Zool. Jahrb., Syst., X. 1897-98, p. 348: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 273: Doflein, SB. Ak. Münch. XXIX. 1899, p. 193.

Closely related to *G. acutus*, from which it can be distinguished by the following characters when fully adult males are compared:—

(1) the regions of the carapace are much more strongly defined, and the raised lines that bound the dorsal plane of the carapace on each side are more curved, less rapidly convergent, and less distinct in their posterior part, which gives the carapace a much less posteriorly-contracted look; and the orbits are less oblique:

(2) the front, measured between the bases of the eyestalks, is about a fifteenth the greatest breadth of the carapace, and its moulded and bevelled edges together take up more than two-thirds of its breadth:

(3) in the large cheliped the arm is longer and more slender, both the oblique granular ridges on the inner surface of the palm are very strongly defined, and the fingers may be fully 3 times the length of the upper border of the palm:

(4) these large fingers are broader and thinner, their tips are somewhat hooked and have no enlarged tooth near them, but near the middle of the immobile finger there is a enlarged tooth or triangular lobe:

(5) the merus of the last pair of legs, though it is compressed and somewhat broadened, is not a short foliaceous joint.

In the Indian Museum are 52 specimens, from Mergui, Andamans and Nicobars, and Bimlipatam.

#### 57. *Gelasimus Urvillei*, Edw.

*Gelasimus Urvillei*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 148, pl. iii. fig. 10: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 145, pl. ix. fig. 15: de Man, Notes Leyden Mus. XIII. 1891, pp. 21, 34: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 750.

*Gelasimus Dussumieri*, Hilgendorf (*nec* Edw.), in v. d. Decken's Reis. Ost-Afr. Crust. p. 84, pl. iv. fig. 1.

This species closely resembles *G. acutus* and *G. Dussumieri*, but is distinguished from both by the presence of a raised row of granules behind and parallel with the middle third of the lower border of the orbit—*i.e.*, just inside the orbital cavity.

As in *G. acutus*, the fine raised lines that define the dorsal plane of the carapace laterally are distinct throughout and rapidly convergent, which gives the carapace a look of breadth in front and of unusual narrowness behind; and, as in *G. acutus*, the meropodites of the last

pair of legs are, even in the male, decidedly shortened and foliaceous joints.

On the other hand the front is, as in *G. Dussumieri*, extremely narrow, and its bevelled and moulded edges take up most of its breadth between the eye-stalks. The regions of the carapace, also, are as strongly defined as they are in *G. Dussumieri*.

The large hand of the male resembles that of *G. Dussumieri* in having both the oblique granular ridges on the inner surface of the palm strongly salient, and in having very long fingers with simple hooked tips: the fingers however are not so broad and thin, and the lobe near the middle of the dentary edge of the immobile finger may be present or not.

In the Indian Museum are 10 specimens, from Karachi, Madras, and the Nicobars.

The carapace of the largest specimen is 20 millim. long and 36 millim. broad.

#### Subfamily SCOPIMERINÆ.

##### *DOTILLA*, De Haan, Stimpson.

*Dotilla*, De Haan, Faun. Japon. Crust. p. 24 (1835) *nom. præoc.*: Milne Edwards, Hist. Nat. Crust. II. 38, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 152.

*Dotilla*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 98.

Cephalothorax so deep as to be subcubical, as long as broad or a little broader than long. Anteriorly the sidewalls of the carapace have a curious gyrous-sulcate sculpture resembling brain-convolutions: often also a similar kind of sculpture is found on the dorsum of the carapace and on the meropodites of the external maxillipeds.

Front a narrow deflexed lobe much as in *Ocypoda*. The orbits, which occupy all the rest of the anterior border of the carapace, are more or less oblique and shallow—in one species so shallow as to be almost obsolete. Eyestalks rather long and slender, with the eyes at the end.

Antennules, like those of *Ocypoda*, having the basal joint of good size, and the flagellum small and hidden by the front. The antennæ stand at the inner angle of the lower orbital border and have a rather short flagellum.

The epistome would be linear but for a large median triangular lobe that projects between the external maxillipeds.

Buccal cavern enormous, suboval or subcircular in outline: the external maxillipeds, which completely cover it and are also very large, have a strong almost hemispherical bulge; their merus is much larger

than the ischium and carries the flagellum at the antero-external angle : the exognath is extremely slender and inconspicuous.

Chelipeds equal, stouter than the legs : fingers usually slender and a little deflexed, usually without conspicuous teeth.

Legs not much differing in length, which is moderate : their meri (as also those of the chelipeds) have on the upper surface a curious membranous area or "tympanum." Similar "tympana" may also be present on some of the segments of the sternum.

The abdomen in the male consists of 7 separate segments, and though narrow is nowhere linear or compressed : the distal end of the fourth segment is thickly fringed with bristles, and overlaps and partly conceals the fifth tergum. In the female, according to De Haan, the abdomen consists of 5 separate segments.

*Distribution* : Tropical shores and mud-flats, from East Africa and the Red Sea eastwards to Japan. Found in the same situations as *Gelasimus* and *Ocypoda*.

*Key to the Indian species of Dotilla.*

- I. Carapace broader than long : chelipeds not much longer than the carapace, and not much differing from the legs in point of length : no "tympana" on the sternum :—
  1. Meropodites of legs not dilated : fingers of chelæ slender, without any conspicuous teeth :—
    - i. Whole surface of merus of external maxillipeds gyrous-sulcate : fingers not longer than palm..... *D. affinis.*
    - ii. Only the outer-half of the merus of the external maxillipeds is gyrous-sulcate :—
      - a. Fingers slightly longer than the palm..... *D. Blanfordi.*
      - b. Fingers more than twice as long as the palm..... *D. intermedia.*
  2. Meropodites of the legs dilated :—
    - i. Fingers of chelæ without any conspicuous tooth : dactyli of the legs, even of the last pair, shorter than the propodites..... *D. brevitarsis.*
    - ii. A large tooth on each finger of the chelæ, arranged so that when the tips of the fingers are closed these large teeth meet, and an hour-glass-shaped space is left between the closed fingers : dactyli of the legs longer than the propodites..... *D. clepsydrodactylus.*
- II. Carapace at least as long as broad : chelipeds 3 or 4 times as long as the carapace, and much longer than the legs : "tympana" present on the sternum..... *D. myctiroides.*



58. *Dotilla affinis*, n. sp.

Differs from *D. sulcata*, with specimens of which, from the Red Sea, I have compared it, only in the following characters:—

(1) there is no spine on the under surface of the arm, (2) the fingers are not so long as the palm, (3) there is a small tympanum on the dorsal surface of the merus of the last pair of legs, whereas in *D. sulcata* only the tympanum on the ventral surface is present.

The carapace behind the gastric and inside the branchial regions, forms a smooth semicircular facet, but all its anterior and lateral regions have a curiously convoluted sculpture, the convexities of the convolutions being finely granular.

The grooves that define these convolutions form, when viewed as a whole, a sort of five-rayed star, the anterior ray (which runs up between the eyes on to the front) being the shortest, the antero-lateral rays (which run towards the outer angles of the orbit) being a little longer, and the postero-lateral rays (which really are triple) being the longest of all.

The pterygostomial regions and neighbouring part of the side-walls of the carapace, and the meropodites of the external maxillipeds have the same curious convoluted sculpture. The orbits are shallow but are perfectly defined.

The merus of the external maxillipeds is more than twice the size of the ischium.

Chelipeds (measured round their curve) not twice the length of the carapace: no spine on any of their segments: fingers not so long as the palm.

Legs slightly longer than the chelipeds, their meropodites not at all broadened but all having a "tympanum": except in the case of the last pair of legs—in which the dactylus is remarkably long—the dactyli are rather shorter than the propodites.

No tympana on the sternum.

In the Indian Museum are 4 specimens from Aden and the Baluchistan coast. The carapace of the largest is 5.3 millim. long and 7.3 millim. broad.

59. *Dotilla intermedia*, de Man.

*Dotilla intermedia*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 135, pl. ix. figs. 4-6 (1888).

Carapace sculptured in much the same way as in *D. affinis*, only the grooves are not so deep and distinct, and there is an additional groove running parallel with the posterior margin.

The merus of the external maxillipeds is not twice as large as the ischium, and the sculpturing consists of a single loop parallel with the outer border of the merus, the inner half of that joint being quite smooth.

Fingers more than twice as long as the palm. In the last pair of legs the dactylus is about twice as long as the propodite: in all the other legs the dactyli are very little longer than the propodites.

In other respects this species agrees with *D. affinis*.

In the Indian Museum are 15 specimens from Mergui. The carapace is 4 millim. long and a little over 4 millim. broad.

#### 60. *Dotilla Blanfordi*, n. sp.

The whole of the dorsal surface of the carapace is areolated and grooved (the areolæ being finely granular and the grooves smooth) as follows:—

A very distinct groove runs parallel with either lateral border, and a scarcely less distinct one runs parallel with the posterior border, and in the space bounded by these grooves a six-rayed star of grooves of nearly equal length can be made out. This "star" is formed by a groove running fore and aft down the middle of the carapace and having, on either side of it, a semicircular chord joining the outer angle of the orbit with a point near the postero-lateral angle of the carapace. The intersection of these grooves cuts the post-gastric sub-region into 4 symmetrical tubercles.

The whole side-wall of the carapace is finely granular, and the sub-hepatic and pterygostomial regions have the characteristic convoluted sculpture. The orbits are shallow but are perfect.

The external maxillipeds are finely granular: the merus is twice as big as the ischium, and its sculpture consists of a single loop parallel with the outer border and a single groove parallel with the inner border.

Chelipeds as in *D. affinis*, except that the fingers are a little longer than the palm.

Legs as in *D. affinis*, the meropodites being slender and all having a "tympanum," but in the last pair the dactylus is about twice as long as the propodite, and in the other pairs the dactyli are very slightly longer than the propodites. No sternal tympana.

In the Indian Museum are 4 specimens from the coast of Sind and Baluchistan. The carapace of the type is a little over 5 millim. long and not quite 7 millim. broad. Collected by Mr. W. T. Blanford, F.R.S.

61. *Dotilla clepsidrodactylus*, n. sp.

Near *D. Wichmanni*, de Man.

The sculpture of the dorsum of the carapace is like that of *D. Blanfordi*, only the grooves are much deeper cut and the groove between the post-gastric region and the postero-lateral angle of the carapace is double: the sculpture of the sidewall of the carapace is like that of *D. Blanfordi*.

In the external maxillipeds the merus is not twice as big as the ischium, and its sculpture consists of a single simple convolution parallel with the outer border, the inner half of its surface being quite smooth—as is *D. intermedia*.

The orbits are shallow but are quite perfect.

The chelipeds, measured all round their curve, are not twice the length of the carapace and have no spine on the arm. The fingers are much longer than the palm: *in the adult male they are extremely slender, and each has a large tooth arranged so that when the tips of the fingers are closely apposed these two teeth meet and leave an hour-glass-shaped space between the closed fingers.*

Legs a little longer than the chelipeds; their meropodites are slightly but distinctly dilated and all have a *tympanum*: their dactyli are all longer than their propodites, and in the last pair the dactylus is very long, slender, straight, and fluted. No sternal tympana.

Colours, speckled like the sand in which they live.

In the Indian Museum are eight specimens from False Point on the sea face of the Mahanaddi Delta. The carapace of the largest is 5 millim. long and 6 millim. broad.

62. *Dotilla brevitarsis*, de Man.

*Dotilla brevitarsis*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 130, pl. ix. figs. 1-3 (1888).

The whole carapace is grooved and areolated (but the sculpture is not very deep) as follows:—

A strong groove runs fore and aft down the middle of the carapace, another runs parallel with the posterior border, and on each side another takes a sinuous course along each lateral border: other short and rather indefinite grooves join the median and lateral grooves.

The subhepatic and pterygostomian regions have the usual convoluted sculpture. Orbits shallow, but distinct.

The merus of the external maxillipeds is much larger than the ischium: its whole surface is sculptured, the sculpture taking the form of a W-shaped convolution.

Chelipeds short, without any spine on the arm : palm short, high, and compressed, with sharp edges, traversed by a fine raised line near and parallel with the lower border : fingers thin and compressed, about as long as the palm, the upper edge of the dactylus—like that of the palm—fringed with hair.

Legs a little longer than the chelipeds, the meropodites—especially of the first 3 pairs—*much broadened and compressed*, all having a tympanum. *The dactyli, even of the last pair of legs, are shorter than the propodites.*

No tympana on the sternum.

In the Indian Museum are fragments of 3 specimens from Mergui : de Man states that the breadth of the cephalothorax of the largest specimen is nearly 10 millim.

### 63. *Dotilla myctiroides*, Edw.

*Doto myctiroides*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, pl. iv. fig. 24.

*Dotilla myctiroides*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 98 : A. O. Walker, Journ. Linn. Soc. Zool. XX. p. 111 : Anriviilus, Zur Biologie amphibischer Dekapoden, p. 5, pl. i. figs. 1-13, pl. iii. fig. 13, (Mitg. Ges. Wiss. Upsala, 1893).

*Scopimera myctiroides*, Henderson, Trans. Linn. Soc., Zool., (2) V. 1898, p. 390.

Carapace about as long as, or slightly longer than, broad, little sculptured dorsally, though its antero-lateral parts are studded with vesiculous granules. Front grooved : a groove runs parallel with either lateral border, and a faint groove crosses either postero-lateral angle. The side-walls anteriorly have the usual "brain-convolution" sculpture.

Orbits very oblique and very shallow, almost obsolete.

The merus of the external maxillipeds is nearly twice as big as the ischium and is finely granular ; a single faint groove, most distinct anteriorly, runs parallel with its outer border.

Chelipeds between three and four times the length of the carapace, all the joints long, slender, and unarmed : fingers longer than the palm, without any conspicuous teeth.

Legs long, but much shorter than the chelipeds : the meropodites strongly dilated, and with a large "tympanum" : the dactylus of the last pair is longer than the propodite, but in the other three pairs it is a little shorter than the propodite.

On either side of each of the last four thoracic sterna is a large tympanum.

In the Indian Museum are 19 specimens from the Andamans and 11 from the Coromandel coast. The carapace is 10 millim. long.

## SCOPIMERA, De Haan.

*Scopimera*, De Haan, Faun. Japon. Crust., p. 24 (1835): Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 153.

*Scopimera* has the same deep "cubical" carapace and the same general facies as *Dotilla*, but differs in the following characters:—

The carapace is much broader than long and has none of the curious sculpture, resembling brain convolutions, that is found, at any rate on the sidewalls, in *Dotilla*: the external maxillipeds are unsculptured and their merus, though large, is smaller than their ischium: the abdomen of the male has a curious wasp-like form owing to the length and narrowness of its fifth segment, which segment may even become elongate-linear by constriction; it has no bristles either on the 4th tergum or elsewhere: in the female the abdomen consists of 7 separate segments.

*Distribution*: Indo-Pacific shores, from Karachi to Japan.

*Key to the Indian species of Scopimera.*

- I. Chelipeds and legs with a reticulate or subsquamiform granulation, the chelipeds in the male about twice the length of the carapace: most of the tympana on the legs are traversed by a longitudinal ridge: fifth abdominal tergum of male long and narrow, but not linear..... *S. investigatoris.*
- II. Chelipeds and legs finely and uniformly granular, the chelipeds in the male nearer 3 times than twice the length of the carapace: the tympana not subdivided by a ridge: the fifth abdominal tergum of the male is long and linear..... *S. crabricauda.*

According to F. Müller, *S. globosa*, De Haan, is found in Indian waters. The form of the abdomen in this species is similar to that of *S. investigatoris*, but the carapace is smooth, and the tympana of the legs are different.

64. *Scopimera investigatoris*, n. sp.

Carapace much broader than long, decidedly pentagonal, without distinction of regions, smooth except anteriorly and laterally where there are numerous irregularly-scattered granules: the sidewalls and pterygostomian regions finely granular.

Orbits broad as in *Ocypoda*, shallow, the upper border very oblique, the lower border finely denticulated and very prominent as in *Gelasimus*.

External maxillipeds with some obsolescent granulation. Chelipeds and legs finely granular in a somewhat reticulate or subsquamiform way.

Chelipeds about twice as long as the carapace: tympanum on the inner surface of the arm large, that on the outer surface of the arm small: fingers about as long as the palm, without any enlarged teeth.

First 3 pairs of legs about the same length as the chelipeds, the 4th pair shorter: the merus of all much dilated and with large well-defined tympana, all of which, except only the one on the dorsal surface of the last pair, are longitudinally subdivided by a fine ridge: the dactylus in the first 3 pairs is about the same length as the propodite, but in the last pair is considerably longer.

In the male abdomen the first 2 segments are horizontal-linear, the 3rd and 4th, though distinct, form a "butterfly" plate, the 5th is long and narrow and longitudinally grooved and gradually expands to meet the 6th, which is long and broad, while the 7th is transversely oval.

In the female the abdomen is of the usual shape, but in its broadest part is little more than half the breadth of the sternum.

In the Indian Museum are 11 specimens, from Diamond Island off C. Negrais in Burma. The carapace of the largest male is 4.5 millim. long and 7 millim. broad.

#### 65. *Scopimeru crabricauda*, n. sp.

Carapace subpentagonal, the regions indistinctly indicated, the surface of the mid-dorsal region is symmetrically puckered or vesiculous; the sidewalls and pterygostomial regions granular.

Orbits moderately broad and deep, the upper border oblique, the lower border prominent and finely denticulate.

External maxillipeds smooth: chelipeds and legs "frosted" under the lens.

In the male the chelipeds are more than  $2\frac{1}{2}$  times the length of the carapace and are longer and much stouter than the legs: there is a large tympanum on the inner surface of the arm, and a very small one on the outer surface: the dactylus is a little shorter than the palm and has one large tooth. In the female the chelipeds are shorter and not much stouter than the legs: the fingers are shorter than the palm, and the dactylus has no large tooth.

The meropodites of the legs are much dilated: all have tympana but these are not subdivided by any ridge: in the first 3 pairs of legs the dactyli are a little longer, in the fourth pair considerably longer, than the propodites.

In the male abdomen the first 2 segments are linear-horizontal and concealed, the 3rd and 4th form a triangular plate deeply grooved down

the middle line, the 5th is long linear and grooved, the 6th and 7th, though separate, together form a racket-head.

In the female the abdomen is of normal shape.

In the Indian Museum are a male and female from Karachi. The carapace of the male is 6·5 millim. long and barely 10 millim. broad.

#### TYPANOMERUS, de Man, Rathbun.

*Diosippe*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 137 (1888): *nom. præocc.*

*Tympanomerus*, Rathbun, Proc. Biol. Soc., Washington, XI. 1897, p. 164.

Carapace deep, quadrilateral, broader than long, the regions not defined. Front narrow, deflexed: the orbits are trenches occupying the whole anterior border of the carapace between the front and the antero-lateral angles.

Eyes, antennules, antennæ and epistome as in *Dotilla*. Buccal cavern large, a little narrowed and rounded anteriorly: the external maxillipeds completely close the buccal cavern, the anterior outer corner of the ischium is marked off as a distinct facet as in *Dotilla* and *Scopimera*, the merus is much larger than the ischium, the palp arises near the antero-external angle of the merus, and the exognath is small and linear.

Chelipeds in both sexes stouter, and in the male longer, than the legs: fingers a little deflexed.

Legs rather compressed, the two middle pairs a little longer than the first and last pair: there are ill-defined tympana on the meropodites.

The abdomen in both sexes consists of separate segments, and in the male is narrow.

*Distribution*: Japanese and Andaman Seas.

The name *Tympanomerus* is a most unfortunate one, since the "tympana," compared with those of *Dotilla* and *Scopimera*, are ill-defined and inconspicuous.

#### 66. *Tympanomerus orientalis* (de Man).

*Diosippe orientalis*, de Man, Journ. Linn. Soc. Zool. XXII. 1887-88, p. 138, pl. ix. figs. 8-10.

Carapace square-cut, the length about four-fifths of the greatest breadth, dorsally nearly flat with the lateral borders well defined especially anteriorly, the surface a little lumpy in places: a perfectly straight fine transverse ridge runs close to and parallel with the posterior border.

Front grooved dorsally, hardly a fourth the breadth of the carapace. The outer angle of the lower border of the orbit forms a

prominent tooth. The merus of the external maxillipeds is grooved along the outer border.

Chelipeds in the male nearly three times the length of the carapace: wrist elongate, somewhat cuboid, with a strong laterally-compressed lobe or tooth at its inner angle: palm rather high, both borders marginate and a second fine ridge runs close to and parallel with the lower border: fingers a little shorter than the palm, finely denticulate.

In the female the chelipeds are not twice the length of the carapace, the wrist is not elongate, though the tooth at its inner angle is present, and the fingers are a little longer than the palm.

The meropodites of the legs are slightly dilated, the dactyli are shorter than the propodites, and the carpopodites and propodites of the first two pairs are densely tomentose.

The fifth abdominal tergum of the male, though not particularly elongate, is a little constricted at base.

In the Indian Museum are 6 specimens from Mergui. The carapace of the largest is 4 millim. long and 5 millim. broad.

#### Subfamily MACROPHALMINÆ, Dana.

##### CLISTOSTOMA, De Haan restr.

*Cleistostoma* (= *dilatata* nec *pusilla*) De Haan, Faun. Japon. Crust. p. 26: Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 160.

Carapace of no great depth, broader than long, its sides slightly arched, its regions ill-defined.

Front of moderate breadth, more than a fourth the greatest breadth of the carapace, declivous: orbits well defined, of good depth, occupying all the rest of the anterior border of the carapace: eyestalks stout, eyes terminal. The antennules fold obliquely: the antennæ are small and stand in the inner orbital hiatus.

Epistome well defined, very short fore and aft, with a prominent lobe or tooth in the middle line projecting between the external maxillipeds.

Buccal cavern squarish, but with the sides a little arched, completely closed by the external maxillipeds. These are large, and have the inner angle of the ischium strongly produced, the merus as large as or larger than the ischium, and the palp articulating at the antero-external angle of the merus: the carpus is ovate, but the two terminal joints are very short and slender: the exognath is in great part concealed.

Chelipeds in the female shorter and slenderer than any of the legs, in form exactly like those of the female of *Gelasimus*.



Of the legs the first two pairs are the shortest and slenderest, while the middle two pairs are much the largest and have very broad meropodites. There are no "tympana."

The abdomen of the female consists of 7 separate segments, and is very broad.

67. *Clistostoma dotilliforme*, n. sp.

Carapace rather depressed, slightly convex, smooth, with the regions ill-defined; its lateral borders are slightly arched and are finely serrated anteriorly behind the acute, almost dentiform, antero-lateral angles. Front between a third and a fourth the greatest breadth of the carapace, concave in the middle line. Upper border of the orbit sinuous, lower border prominent and finely serrated.

Merus of the external maxillipeds larger than the ischium, sculptured (somewhat as in the *Dotillæ*) with a sort of Y-shaped sulcus starting from the antero-external angle. The pterygostomial regions also are sculptured with branching or convoluted grooves much as in the *Dotillæ*.

The second and third pair of legs, which are much longer than the other two pair, are a little over  $1\frac{1}{2}$  times the length of the carapace and have an almost foliaceous meropodite with the anterior border finely serrulate and the posterior border elegantly spinate: the anterior border of the carpus and propodite of the second and third pair of legs is tomentose.

A single egg-laden female is in the Indian Museum: it was found at Karachi, and its carapace is 7 millim. long and 9 millim. broad.

TYLODIPLAX, de Man.

*Tylodiplax*, de Man, Zool. Jahrb., Syst. VIII. 1894-95, p. 598 (1895).

Carapace deepish, quite flat dorsally, broader than long and broader behind than in front, the lateral borders being posteriorly divergent and having a distinctly convex curve, the regions more or less defined.

Front between a third and a fourth the greatest breadth of the carapace, not deflexed, grooved longitudinally. The orbits occupy the rest of the anterior border of the carapace, but as the extent of this border is a good deal less than the greatest breadth of the carapace, and as the front is broad, the orbits have not the same elongate form as they have in most species of *Macrophthalmus*, though otherwise similar. Antennules and antennæ as in *Macrophthalmus*. Eyes small, not terminal on the eyestalks.

The epistome would be linear, were it not for a septum-like fold or lobe that projects strongly between the meropodites of the external maxillipeds: owing to this fold the anterior edge of the buccal cavern has a bilobed appearance. The external maxillipeds completely close the buccal cavern: their merus is at least as long as and decidedly broader than their ischium: the flagellum, which is slender, is articulated near, but not at, the antero-external angle of the merus: the exognath is not much concealed, though not completely exposed.

The chelipeds in the adult male are unknown: in the young male they are equal and are shorter and slenderer than the legs, except perhaps the very small 4th pair.

The legs have somewhat the same relations as in *Macrophthalmus*—i.e., the first and last pairs are much the shorter and the two middle pairs are much the longer and stouter.

The abdomen in the female is unknown: in the male it is narrow, and consists of 5 separate joints, the 3rd 4th and 5th segments being fused, but without obliteration of sutures.

It seems to me of very doubtful utility to separate this form from *Paraclistostoma*, de Man, or either of them from *Clistostoma*, De Haan (as restricted by de Man).

#### 68. *Tylodiplaz indica*, n. sp.

Two young males from Karachi are in the Indian Museum: their chelipeds are still of the female *Macrophthalmus* type, so that it is impossible to give a complete diagnosis of the species.

Carapace more or less hairy, finely punctate, its length less than two-thirds its greatest breadth which, owing to the strong divergence, from before backwards, of the lateral borders, is posterior; its antero-lateral angle is an obtuse angle. The gastric region is defined by a perfectly circular line.

Front square-cut, laminar, but not projecting beyond the inner angles of the orbits, from which it is separated by a groove: the front is concave in the middle line.

The pigment of the eyes is small in amount, and is placed some distance behind the end of the eyestalks.

The merus of the external maxillipeds is longer and much broader than the ischium, and has its antero-external angle considerably dilated, and its surface somewhat granular.

The chelipeds of the immature male, and the legs, are hairy, much as in *Macrophthalmus depressus*, the hairs on the posterior border of the merus of the 2nd pair of legs and on the dorsal surface of carpus and propodite of the 2nd and 3rd pair of legs being particularly

thickset. The length of the longest (second) pair of legs is  $2\frac{1}{2}$  times that of the carapace, that of the last pair of legs is very little more than that of the carapace.

Two young males from Karachi: the carapace 6.5 millim. long and 11 millim. broad.

#### MACROPTHALMUS, Latreille.

*Macrophthalmus*, Latreille, in Cuvier Règne An. (ed. 2) Vol. IV. p. 44 (1829): De Haan, Faun. Japon. Crust. p. 26: Milne Edwards, Hist. Nat. Crust. II. 63, and Ann. Sci. Nat., Zool. (3) XVIII. 1852, p. 155: Dana, U. S. Expl. Exp., Crust. pt. I. p. 312: Miers, Challenger Brachyura, p. 248.

Carapace depressed, quadrilateral, broader than (sometimes more than twice as broad as) long: the regions are well defined, the cervical and branchial grooves being characteristically conspicuous both on the dorsum of the carapace, and on the lateral border where they cut out two prominent teeth or lobes.

Front deflexed, narrow, often a narrow lobe as in *Gelasimus*: its free edge never approaches the epistome. The orbits are narrow trenches occupying the whole anterior border of the carapace between the front and the antero-lateral angles: eyestalks usually very long and slender, as in *Gelasimus*. The antennular flagella, which are rather small, fold transversely beneath, but are not concealed by, the front. The antennæ stand at the inner angle of the orbit: the basal joint is short, and the flagellum is of good length.

Epistome very short fore and aft, almost linear, but well delimited from the palate. Buccal cavern somewhat arched anteriorly. The external maxillipeds have a broad foliaceous ischium and merus (the latter about half the length of the former) and a coarse flagellum articulating with the antero-external angle of the merus: though the ischium and merus may not quite meet across the middle of the buccal cavern, the narrow interval that may exist between them is largely filled by the flagella, so that the underlying parts are concealed.

The chelipeds differ greatly in the sexes: in the female they are equal, and are shorter and slenderer than any of the legs except, perhaps, the short and weak last pair: in the *adult* male they are equal or subequal, and are longer and stouter than any of the legs except, perhaps, the particularly large and stout penultimate pair: in both sexes the fingers are curiously deflexed and bent or curved inwards distally.

Of the legs, the first and last pairs are usually singularly short and slender compared with the second and third pairs: the third pair are the longest and stoutest, being nearly or quite as large as the chelipeds,

and the fourth (last) pair much the shortest and weakest of all. The dactylus in all is broad, stout, and laterally compressed.

The abdomen in both sexes consists of 7 separate segments, and in the male is narrower at base than the breadth of the sternum.

*Key to the Indian species of Macrophthalmus.*

- I. Carapace much broader than long, its sides are distinctly convergent posteriorly and the antero-lateral angles are acute and spiniform: front narrow:—
  1. The eyestalks project *nearly half their length* beyond the antero-lateral angles of the carapace..... *M. Ferreauxi.*
  2. The eyestalks project slightly beyond the antero-lateral angles of the carapace: the true first tooth of the lateral border of the carapace belongs to the upper border of the orbit, and the antero-lateral angle of the carapace is formed by the true second tooth..... *M. sulcatus.*
  3. The eyestalks do not project beyond the antero-lateral angles of the carapace:—
    - i. Some of the borders of some of the leg joints are denticulate or spiny..... *M. pectinipes.*
    - ii. Legs smooth, except for a small subterminal denticle on the anterior border of the meropodites ..... *M. convexus.*
- II. Carapace broader than long, its sides are parallel:—
  1. The tooth at the antero-lateral angle of the carapace is truncate and square-cut: front about an eighth the greatest breadth of the carapace: inner surface of the palm of the male smooth..... *M. depressus.*
  2. Front about a fourth the greatest breadth of the carapace: inner surface of the palm of the male armed with a spine..... *M. erato.*
- III. Carapace broader than long, its sides divergent posteriorly: two nearly parallel, obliquely longitudinal, finely beaded lines on the posterior part of each epibranchial region ..... *M. tomentosus.*

Besides the fore-named, the four following species, of which I have not seen specimens, are said to occur in Indian Seas:—

(1) *M. simplicipes*, Guérin, Mag. de Zool. II. 1838, pl. xxiv. fig. 1: it appears to differ from *M. pectinipes* in having no spines or denticles on the leg-joints.

(2) *M. carinimanus*, Milne Edwards, Hist. Nat. Crust. II. 65, and Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 156: it appears to differ from *M. convexus* only in having a spine on the inner surface of the palm of the male cheliped.

(3) *M. pacificus*, Dana, U. S. Expl. Exp., Crust. pt. I. p. 314, pl. xix. fig. 4: it appears to differ from *M. erato* only in not having a spine on the inner surface of the palm of the male cheliped.

*M. bicarinatus*, Heller, Novara Crust. p. 86, pl. iv. fig. 2, which I am unable from the descriptions to distinguish from *M. pacificus*.

69. *Macrophthalmus Verreauxi*, Edw.

*Macrophthalmus Verreauxi*, Milne Edwards, Ann. Sci. Nat., Zool., (3) IX. 1848, p. 358, and XVIII. 1852, p. 155, pl. iv. fig. 25: Hess, Archiv f. Nat. XXXI. 1865, i. pp. 142, 171: de Man, Notes Leyden Mus. II. 1880, p. 184: Haswell, Cat. Austral. Crust. p. 89.

Carapace finely granular on the branchial regions, its length about two-thirds its greatest breadth, its sides slightly convergent posteriorly and cut anteriorly into 3 teeth, the first of which is the antero-lateral angle.

Front only very moderately deflexed, its least breadth (between the eyestalks) is about a fifth the greatest breadth of the carapace, very obscurely bilobed.

Orbits oblique, sinuous, their borders microscopically beaded. *The eyestalks project nearly half their length beyond the antero-lateral angles of the carapace.*

The external maxillipeds, when the flagella are folded, completely occlude the buccal cavern: the suture between the merus and ischium is oblique.

The legs are darkly variegated or incompletely banded, and are unarmed except for a subterminal spine on the anterior border of the meropodites of the first 3 pairs.

The chelipeds in the young male are not as long as, though more massive than, the 2nd and 3rd pairs of legs.

In the Indian Museum are 4 specimens, more or less damaged, from the Andamans and Mergui ("Investigator" collection). The largest male (which wants the chelipeds) has a carapace 9 millim. long and 14 millim. broad.

70. *Macrophthalmus pectinipes*, Guérin.

*Macrophthalmus pectinipes*, Guérin, Voy. Favorite, p. 167, pl. 49 (1839), and Mag. de Zool. II. 1839, Crust. (Cl. VII.) pl. xxiii (1838): Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 158: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 389: Ortmann, Zool. Jahrb., Syst., X. 1897-98, p. 340.

Carapace studded with large conspicuous pearly granules, its length in the adult male is about six-elevenths of its greatest breadth at the level of the second tooth of the lateral border: the lateral borders are slightly but distinctly convergent posteriorly where they are beaded or denticulate, anteriorly they are cut into three acute teeth the last of which is minute, the first being the outer orbital angle.

The front, measured at its narrowest part between the eyestalks, is barely a sixteenth the greatest breadth of the carapace: its free edge is distinctly bilobed. Orbits sinuous, a little oblique; their upper border

elegantly denticulate, the lower border unevenly crenulate. Eyestalks slender and curved: the eye does not reach to the end of the orbital trench.

When their flagella are folded the external maxillipeds completely occlude the buccal cavern: the suture between the ischium and merus is hardly at all oblique.

In the adult male the chelipeds are from  $2\frac{1}{2}$  to 3 times the length of the carapace and longer than any of the legs except the 3rd (penultimate) pair: except the hand, their joints are not more massive than those of the 2nd and 3rd pair of legs. The arm is trigonal, its inner border being prominent and rising into a crest, on the most convex part of which is a short horny plate, called by de Man the "musical ridge": this border of the arm, as also the inner border and angle of the wrist and the extreme proximal end of the upper border of the palm, is serrated. The palm is nearly as long as the arm and is perfectly smooth and unsculptured, it has a tuft of hair at its extreme distal end, continuous with a thick fringe of hair along the upper border of the dactylus: the dactylus is about two-thirds the greatest length of the palm and has a molariform tooth at its basal end, but there is no such tooth on the immobile finger: the fingers meet only at the distal inbent end.

In the female and young male the chelipeds are short and slender, a good deal fringed with hair, but unsculptured, and the fingers are longer than the palm.

In both sexes the legs are alike, the 2nd and 3rd pairs being remarkably long and strong and the 1st and 4th (last) pairs being short and comparatively slender. The 3rd pair, which are the longest of all, are from  $2\frac{1}{2}$  to nearly 3 times the length of the carapace, the 4th pair are only about  $1\frac{1}{2}$  times the length of the carapace. In all but the last pair the meropodites carpopodites and propodites are scabrous, the anterior border of all these joints and the distal end of the posterior border of the meropodites being serrated: in the third pair only the posterior border of the propodite is very strongly serrated.

In the Indian Museum are 7 specimens from Karachi and one from Orissa. In a large male specimen the carapace is 35 millim. long and 62 millim. broad.

The great changes that occur in the chelipeds during the growth of the male indicate that caution is necessary in basing specific distinctions on the form of these organs in this genus.

#### 71. *Macrophthalmus convexus*, Stimpson.

*Macrophthalmus convexus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 97: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 307: Haswell, Cat. Austral. Crust. p. 89:

de Man, *Archiv f. Naturges.* LIII. 1887, i. p. 354, pl. xv. fig. 4: *Ortman*, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 745 and X. 1897-98, pp. 342, 344.

*Macrophthalmus inermis*, A. Milne Edwards, *Ann. Soc. Ent. France*, (4) VII. 1867, p. 286, and *Nouv. Archiv. du Mus.* IX. 1873, p. 277, pl. xii. fig. 5 (*apud de Man*).

Carapace smooth, becoming finely granular near the lateral margins, its length in the male is half, in the female decidedly more than half, its greatest breadth: on either branchial region, behind the branchial groove, are two granular eminences, one behind the other: 3 teeth arranged as in *M. pectinipes* at the anterior end of the posteriorly-convergent lateral borders, the first (outer orbital angle) being the most prominent and much the largest, the third minute.

Front, in its narrowest part between, the eyestalks, about one-eleventh the greatest breadth of the carapace, its free edge obscurely bilobed. Orbits considerably oblique, the upper border microscopically beaded, the lower border finely and elegantly serrate. The eyestalks are slender and curved, and the eyes reach to the end of the orbital trench.

The suture between the ischium and merus of the external maxillipeds is decidedly oblique, and there is a distinct gap between these appendages even when their flagellum is folded.

The chelipeds have the same general proportions as in *M. pectinipes*: all the borders of the arm are granular or denticulate, but there is no "musical ridge" on the inner border: a bunch of spinules at the inner angle of the wrist: both borders of the palm, but particularly the lower border, are finely granular, and a fine raised granular line runs along the outer surface of the palm parallel with the lower border: the inner surface of the palm, like that of the fingers, is hairy, but quite smooth and unarmed beneath the hair: there is a small molariform tooth at the base of the dactylus, and a larger one having a forward slant on the immobile finger.

The legs have the same general proportions as in *M. pectinipes*, but they are quite smooth and unarmed, except for a small subterminal spine on the anterior border of the meropodites of the 2nd and 3rd pair.

In the Indian Museum are 5 specimens from the Andamans. The carapace of the largest specimen is 10.5 millim. long and 21.5 millim. broad.

## 72. *Macrophthalmus sulcatus*, Edw.

*Macrophthalmus sulcatus*, Milne Edwards, *Ann. Sci. Nat. Zool.* (3) XVIII. 1852, p. 156: *Ortman*, *Zool. Jahrb. Syst.* X. 1897-98, pp. 344, 345 (*nec synon.*).

Carapace free of granules in the female, studded with minute granules in the male, its length in the male only about three-eighths, in the female nearly half, its greatest breadth. On the branchial region,

behind the branchial groove, are, in both sexes, three granular eminences, one behind the other, the last being on the posterior border. The lateral borders are convergent: their true *first* tooth, which in other species is at once the antero-lateral angle of the carapace and the outer angle of the orbit, appears in this species to belong to the *upper border* of the orbit, so that the antero-lateral angle of the carapace is formed by the much larger *second* tooth which also is the *apparent* outer orbital angle.

The least breadth of the front, between the eyestalks, is about an eighth the greatest breadth of the carapace: its free edge is very obscurely bilobed.

Orbits sinuous and oblique: the upper border microscopically beaded and furnished near its outer end with a sharp recurved tooth, which is really the outer orbital angle, though the apparent angle is the much larger tooth of the lateral border of the carapace: the lower orbital border is finely denticulated in its inner two-thirds, but is broken and indistinct beyond this. Eyestalks long, slender, curved: the eyes reach not only beyond the true limits of the orbit, but also beyond the antero-lateral angle of the carapace.

The external maxillipeds do not quite meet across the buccal cavern: the suture between the ischium and merus is decidedly oblique.

The legs and chelipeds have the same general proportions as in *M. pectinipes*, but the legs are unarmed.

In the male chelipeds the anterior border of the arm is hairy and strongly denticulated, but there is no "musical ridge:" the inner angle of the wrist and the proximal part of the upper border of the palm are also denticulated. On the outer surface of the palm there is a crest running close to, and parallel with, the lower border; and on the inner surface of the palm, near the middle line, is a longitudinal row of denticles the first one of which is considerably enlarged: the surface above this ridge, as also the inner surface of the fingers, is densely hairy. The dactylus is not nearly two-thirds the length of the palm: the immobile finger, but not the dactylus, has a strong molariform tooth at its basal end.

In the female the chelipeds are short and weak as usual, and the hand is quite smooth and has the borders—but specially the lower border—thin and sharp.

In the Indian Museum are a male and a female from the Andamans: the carapace of the male is 9 millim. long and 24 millim. broad.

### 73. *Macrophthalmus depressus*, Rüpp.

*Macrophthalmus depressus*, Rüppell, 24 *Krabben* Roth. Meer. p. 19, pl. iv. fig. 6, pl. vi. fig. 13: Milne Edwards, *Hist. Nat. Crust.* II. 66, and *Ann. Sci. Nat. Zool.* (3)



XVIII. 1852, p. 159: Heller, SB. Ak. Wien, XLIII. 1861, i. p. 362: de Man, Notes Leyden Mus. III. 1881, p. 255, and Archiv f. Naturges. LIII. 1887, i. pl. xv. fig. 3, and Journ. Linn. Soc., Zool., XXII. 1887-88, p. 124, and Zool. Jahrb., Syst. VIII. 1894-95, p. 578: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 389: Ortman, Zool. Jahrb., Syst. VII. 1893-94, p. 745 (?) and X. 1897-98, pp. 341, 342.

*Macrophthalmus affinis*, Guérin, Mag. de Zool. II. 1838, pl. xxiv. fig. 2: Milne Edwards, Ann. Sci. Nat. (3) XVIII. 1852, p. 158: Haswell, Cat. Austral. Crust. p. 88 (*apud* Ortman).

Carapace studded with minute granules not always plainly visible to the naked eye, its length in the male about two-thirds of its breadth. The lateral borders are parallel and the antero-lateral angle is rather a square-cut lobe than a tooth. On the epibranchial regions, behind the branchial groove, are two nearly parallel obliquely-longitudinal finely-granular lines, the inner of which is faint.

Front, at its narrowest part, about an eighth the breadth of the carapace, longitudinally grooved, but its free edge is straight and not bilobed.

Orbits little sinuous and little oblique, their upper border microscopically, their lower border finely and evenly denticulate. Eyestalks slender, hardly curved, the eyes reach almost to the end of the orbital trenches.

When the flagella are folded there is not much space between the external maxillipeds: the suture between the ischium and merus of these appendages is hardly oblique.

In the male the chelipeds and legs have much the same general proportions as in *M. pectinipes*, but they are unarmed, except for a small subterminal denticle on the anterior border of the meropodites of the first three pairs of legs: on the other hand the inner surface of the joints of the chelipeds, and the upper surface of the leg-joints (especially of the meropodites) are densely hairy. The dactylus is more than two-thirds the length of the palm, which is smooth and unsculptured: there is a molariform tooth near the basal end of the dactylus, and a similar, but less distinct and more oblique, tooth on the immobile finger.

In the Indian Museum are 2 males from Mergui, besides several specimens from Aden. The carapace of the largest specimen is 14 millim. long and 22 millim. broad.

#### 74. *Macrophthalmus erato*, de Man.

*Macrophthalmus erato*, de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 125, pl. viii. figs. 12-14, and Zool. Jahrb. Syst., VIII. 1894-95, p. 579.

Carapace quadrilateral, not granular to the naked eye, its length about two-thirds of its breadth, the cervical groove plain, but the

branchial groove faint: the second tooth of the lateral border is a little more prominent than the first. *Front* about two-ninths the breadth of the carapace, square cut, longitudinally grooved, but not bilobed. Orbits slightly sinuous, hardly oblique: eyestalks little curved, stoutish, not quite reaching end of orbit. In the male the lower border of the orbit is peculiar: it is finely denticulate at its internal extremity and has a small lobule at its outer angle, and in between these it has the form of a prominent deflexed somewhat triangular lobe. In the female the lower border of the orbit is finely crenulate throughout. The external maxillipeds do not quite meet across the buccal cavern, and the suture between their ischium and merus is a little oblique.

All three borders of the arm are serrated, and the inner angle of the wrist and upper border of the arm are very finely denticulated. There is a strong "musical crest" obliquely parallel with the inner border of the arm and in the middle third of that border. Palm longer than the arm, its inner surface is hairy and carries a spine near the carpal end about midway between the upper and lower borders. The fingers are considerably less than two-thirds the length of the palm: there is a molariform tooth at the base of the dactylus and a larger slanting one on the immobile finger.

The upper surface of the legs, especially in the case of the third pair, is hairy.

In the Indian Museum are 4 specimens from Mergui and Akyab: the carapace of the largest specimen is 10 millim. long and 14 millim. broad.

#### 75. *Macrophthalmus tomentosus*, Eyd. and Soul.

*Macrophthalmus tomentosus*, Eydoux and Souleyet, Zool. Voy. Bonite, I. p. 243, pl. iii. fig. 8, (1841): Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 159: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 279: de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 122.

Carapace studded with very fine granules: its length is about two-thirds its greatest breadth, which is behind the middle of the lateral border, the lateral borders being decidedly divergent posteriorly. On either epibranchial region, behind the branchial groove, are two finely beaded obliquely-longitudinal lines. The first two teeth of the lateral borders are square-cut.

Front, in its narrowest part, about one-eleventh the greatest breadth of the carapace; though longitudinally grooved it is not bilobed.

Orbits hardly sinuous, not oblique; their upper border microscopically beaded, their lower border finely crenulate. The eyestalks are hardly curved, and the eyes do not reach to the end of the orbits.

The chelipeds and legs have the same general proportions as in *M. pectinipes*, but are shorter. Chelipeds unarmed and unsculptured, except for some spinules along the inner angle of the wrist and some denticles along the proximal part of the upper border of the palm: in the distal half of the inner border of the arm is a short upstanding horny "musical crest": the borders of the arm and the inner border of the fingers are hairy. The dactylus has a small molariform tooth near the base, and the immobile finger has a much larger one.

The legs are unarmed, except for a small subterminal denticle on the anterior border of the meropodites of the first 3 pairs: the upper surfaces of their joints are more or less hairy.

In the Indian Museum is a single specimen from Mergui: its carapace is 23 millim. long and 34 millim. broad.

### Family MICTYRIDÆ, Dana.

#### MICTYRIS, Latreille.

*Mictyris*, Latreille, Gen. Crust. et Ins. p. 40 (1806), and in Cuvier Règne Animal, III. p. 21: Desmarest, Consid. Gen. Crust. p. 115, and Dict. Sci. Nat. XXVIII. 1823, p. 235: De Haan, Faun. Japon. Crust. p. 24: Milne Edwards, Hist. Nat. Crust. II. 36, and in Cuvier Règne An., Crust. p. 67, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 154: Miers, Challenger Brachyura, p. 278.

Carapace elongate globose, oval but truncated posteriorly by the short and perfectly straight posterior border, the cervical and cardio-branchial grooves well developed and making the regions very distinct and convex, the posterior border fringed with bristles, as is also the apposed very prominent edge of the first abdominal tergum.

The afferent branchial orifice is a singular valvular recess, formed dorsally by a semicircular notch in the margin of the carapace, and ventrally by a curious cup-shaped dilatation of the base of the epipodite of the external maxillipeds.

Front a narrow deflexed lobe as in *Ocypoda*. Orbits represented by a small post-ocular spine, the eyes, which are borne on shortish stalks, being quite unconcealed.

Antennules as in *Ocypoda*, the basal joint being large and exposed, while the flagellum is rudimentary and concealed beneath the front. Antennæ small but well formed, standing in the usual position.

Epistome short lozenge-shaped. Buccal cavity enormous, somewhat oval in outline. External maxillipeds very large and foliaceous, with a hemispherical bulge causing them to face as much laterally as ventrally: their greater part is formed by the ischium, the inner margin of which is hairy, especially at base: the merus is very much smaller

than the ischium and carries the coarse hairy flagellum at its antero-external angle: the exognath is small, slender, and very inconspicuous.

Chelipeds moderately long and rather slender, stouter and a little shorter than the legs; their freest motion is in a vertical plane: the wrist is a rather elongate trigonal obconical joint.

Legs somewhat compressed: the first pair are the longest and the others decrease slightly in length in posterior succession.

The abdomen in both sexes is of a broad truncate-oval shape, the segments from the 2nd to the 6th gradually increasing in length but the 7th being narrow: in both sexes the abdomen is fringed with hairs.

*Distribution:* Indo-Pacific from China and Australia to the Andamans.

In habits the species of *Mictyris* resemble the *Ocypodes*, *Gelasimi* and *Dotillæ*.

#### 76. *Mictyris longicarpus*, Latreille.

*Mictyris longicarpus*, Latreille, Gen. Crust. et Ins. p. 41 (1806): Desmarest, Consid. Gen. Crust. p. 115, pl. xi. fig. 2, and Dict. Sci. Nat. XXVIII. p. 236: Guérin, Icon. Règne An. Crust. pl. iv. fig. 4: Milne Edwards, Hist. Nat. Crust. II. 37, and in Cuvier Règne An. Crust. pl. xviii. fig. 2, and Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 151: Dana, U. S. Expl. Exp. Crust. pt. I. p. 389: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 99: Hess, Archiv f. Nat. XXXI. 1865, p. 142: Heller, Novara Crust. p. 10: A. Milne Edwards, Nonv. Archiv. du Mus. IX. 1873, p. 276: Tozzetti, Magenta Crust. p. 185, pl. xi. figs. 5, 5a-c: Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 22, pl. i. figs. 5-7 (gastric teeth): Haswell, Cat. Austral. Crust. p. 116: Miers, Zool. H. M. S. Alert, pp. 184, 248, and Challenger Brachyura, p. 278: de Man, Archiv f. Naturges. LIII. 1887, i. p. 358, and Notes Leyden Mus. XII. 1890, p. 83: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 390: Aurivillius, Zur Biol. Amphib. Dekap. p. 38, pl. iii. figs. 10-11 (Mitg. K. Ges. Wiss. Upsala, 1893): Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 748, and in Semon's Forschungr. Crust. p. 58 (Jena. Denks. VIII): Stead, Zoologist, (4) II. 1896, p. 307: Nobili, Ann. Mus. Genov. (2) XX. 1890, p. 272.

Carapace smooth, the regions moderately convex and dividing the dorsal surface into four lobes: edge of front broadly triangular: *linea anomurica* very distinct.

Chelipeds a little over  $1\frac{1}{2}$  times the length of the carapace: a strong spine at the inner angle of the ischium (sometimes absent in the female): usually some spinules along the distal part of the lower border of the arm: wrist with the upper border of the outer surface marginate, and with a tooth near the middle of the distal border of the inner surface: palm much shorter than the wrist and not much more than half the length of the fingers; the upper and lower borders of its outer surface are marginate, and the middle of its outer surface is traversed by two divergent ridges which are continued along the

fingers: fingers slender and tapering, in the male there is an enlarged tooth near the base of the dactylus.

The legs, like the chelipeds, are rough under the lens: the edges of their propodites and dactyli are finely plumed: none of their joints are dilated: the first pair, which are slightly the longest, are about  $1\frac{1}{2}$  times the length of the carapace.

In the Indian Museum are 5 specimens from the Andamans and 2 from the Nicobars.

### Family HYMENOSOMIDÆ, Ortm.

#### *Key to the Indian Genera or Sub-genera.*

- I. Front conspicuously tridentate: the external maxillipeds do not quite meet across the buccal cavern and their exognath is not hidden in its proximal portion: chelipeds much more massive than the legs ... .. HYMENOCUS.
- II. Front broadly triangular, or truncated: the external maxillipeds completely close the buccal cavern and their exognath is completely hidden:—
  1. The interantennular septum is a prominent plate: chelipeds in the male much more massive than the legs ... .. ELAMENA.
  2. The interantennular septum is a mere ridge; chelipeds in both sexes slender, not stouter than the legs ... .. TRIGONOPLEX.

#### ELAMENA, Edw.

*Elamena*, Milne Edwards, Hist. Nat. Crust. II. 83, and Ann. Sci. Nat., Zool., (3) XX. 1853, p. 223: Dana U. S. Expl. Exp. Crust. pt. I. p. 379: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 321.

Carapace flat dorsally, thin and almost lamellar, triangular or sub-circular, its edges are usually turned up to form a thin circumscribing ridge and are without any teeth. Front broadly triangular, or sometimes truncated. There are no orbits and the eyes, though they may be hidden beneath the front, are exposed and non-retractile: a small post-ocular tooth may be present or not. The antennules fold beneath the front and are not visible from above when folded: the interantennular septum is a prominent plate. Antennal peduncle slender, the flagellum of no great length.

Epistome well defined and remarkably long fore and aft. Buccal cavern square; the external maxillipeds, which completely close it, have the means about as large as the ischium, the palp articulating not far from the antero-external angle of the merus, and the exognath slender and concealed.

Chelipeds in the male subequal, massive, especially as to the palm. Legs long and slender.

The abdomen of the male does not quite fill all the space between the last pair of ambulatory legs.

77. *Elamena sindensis*, n. sp.

Carapace broadly pyriform, smooth, flat, with no distinction of regions: its edge, which is slightly turned up, is entire and unarmed. Front a prominent broad triangular lamina, somewhat rounded at tip. No post-ocular tooth. Interantennular septum very prominent. Eyes not quite concealed beneath the front.

Male chelipeds about  $1\frac{2}{3}$  times as long as the carapace, palm massive and somewhat swollen, fingers stout and pointed and meeting throughout their length. Female chelipeds little longer than carapace, slender, with a slender palm and longish fingers spooned at tip.

Legs slender, the 1st pair not three times as long as the carapace: in all, there is a distinct tooth at the end of the anterior border of both the merus and carpus, and the dactylus is long compressed and falcate with two or three teeth at the end of its posterior border.

In the Indian Museum are 7 specimens from Karachi: the carapace of a male is 5 millim. long and 6 in greatest breadth.

78. *Elamena truncata* (Stimpson ?).

? *Trigonoplas truncata*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 109.

*Elamena truncata*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 323: J. R. Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 395.

Carapace orbiculate-ovate, smooth, flat, with no distinction of regions, its edge, which is slightly turned up and entire and unarmed, shows the faintest traces of angulation in 2 or 3 places. No post-ocular tooth; eyes quite concealed beneath the front. The front, though it projects slightly beyond the carapace is *broadly truncated*, having its free margin cut quite straight. Interantennular septum very prominent. The female chelipeds and the legs are as in the preceding species, the anterior border of the merus and carpus of all the legs ending in a strong tooth.

In the Indian Museum is a female from the Nicobars.

TRIGONOPLAX, Edw.

*Trigonoplas*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 224.

This is best regarded as a subgenus of *Elamena*, from which it differs only in the following unimportant particulars:—(1) the edge of the carapace is not turned up, (2) the interantennular septum is a mere ridge, (3) the chelipeds in the male, as in the female, are very slender.

79. *Elamena (Trigonoplax) unguiformis*, De Haan.

*Elamene unguiformis*, De Haan, Faun. Japon. Crust. p. 75, pl. xxix. fig. 1 and pl. H : J. R. Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 394.

*Trigonoplax unguiformis*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 224 : Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 31.

Carapace smooth, flat, lamellar, broadly pentagonal with the postero-lateral sides about a third as long as any of the others, the regions not defined, the sides entire, unarmed. Front a broad, horizontal, triangular lamina. No post-ocular tooth: eyes not concealed by the front, though the eyestalks are. Interantennular septum a mere ridge.

Epistome as long as broad. Chelipeds and legs smooth and slender.

Chelipeds not stouter than the legs, about  $1\frac{1}{2}$  times as long as the carapace: fingers slender, as long as the slender sub-cylindrical palm, their tips spooned.

The anterior border of the meropodite of all the legs ends in an inconspicuous denticle, the dactylus of all is long, subfalciform, and strongly compressed, and has two or three denticles at the tip of the posterior border. The 2nd and 3rd pair of legs, which are the longest, are more than three times the length of the carapace.

In the Indian Museum are 5 specimens from the Andamans. The carapace of one is 12 millim. long and 14 in greatest breadth.

## HYMENICUS, Dana.

*Hymenicus*, Dana, Amer. Journ. Sci. (2) XII. 1851, p. 290, and U. S. Expl. Exp. Crust. pt. I. p. 337 : Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 224.

Differs from *Elamena* only in the following particulars:—

(1) the front is tridentate and the ridge that defines the edge of the carapace dorsally is continued across its base between the eyes: (2) the interantennular septum, as in *Trigonoplax*, is a mere ridge: (3) on either lateral border of the carapace teeth are sometimes present: (4) the external maxillipeds do not quite meet across the buccal cavern and their exognath is not hidden in its proximal portion.

*Rhynchoplax* of Stimpson (Proc. Ac. Nat. Sci. Philad. 1858, p. 109) is probably synonymous.

*Key to the Indian species of Hymenicus.*

- I. Median spine of the rostrum of moderate length :  
3 teeth on either lateral border of the carapace ... *H. Wood-Masoni*.
- II. Median spine of the rostrum very long : no teeth on  
the lateral borders of the carapace ... .. *H. inachoides*.

80. *Hymenicus Wood-Masoni*, n. sp.

Body and chelipeds tomentose. Carapace dorsally flat or sunken, longer than broad, circular without the rostrum, the regions demarcated by fine grooves.

The front, which is delimited from the rest of the carapace by a fine raised line running across its base between the eyes, is cut into 3 prominent teeth, the middle one of which is somewhat the largest. The antennules fold beneath the front.

A small post-ocular denticle: a large tooth on the lateral border of the carapace above the base of the 1st pair of legs, another, hardly smaller, midway between this and the front, a third, much smaller, midway between this and the post-ocular denticle.

Chelipeds in the adult male more than twice the length of the carapace, very much stouter than the legs, the palm being especially massive. When decuded, the upper border of the arm is dentate and there is a stout spine near the far end of the outer border of this joint: there are several sharp tubercles on the upper surface of the wrist, the outer surface of the palm is reticulate in places, and the fingers which are stout and as long as the palm, have elegantly interlocking teeth.

In the female the chelipeds are considerably shorter and, though stouter than the legs and formed on the male pattern, are not nearly so stout as in the male.

The legs have long, curved dactyli, which are armed with small recurved teeth at the distal end of the posterior border: the 2nd pair, which are a little the longest, are over  $2\frac{1}{2}$  times the length of the carapace.

Carapace of male (including rostrum) 7.5 millim. long and 6 broad.

Specimens were collected by the late Professor Wood-Mason at Port Blair in the Andamans, and at Port Canning near Calcutta.

81. *Hymenicus inachoides*, n. sp.

Carapace somewhat tomentose, flat, elongate-triangular, ending in a rostrum of three long teeth of which the middle one is about a third the length of the rest of the carapace, the other two being more than half the length of the middle one. The regions are all well defined by grooves. No spines on the lateral borders of the carapace. Post-ocular denticle hardly distinguishable. The antennules fold beneath the front.

Chelipeds of the adult male somewhat tomentose, not  $1\frac{1}{2}$  times the length of the carapace: arm slender, with a tooth near the distal end of the outer border; palm short, high, produced and somewhat swollen below; the fingers a little longer than the palm, stout, and finely toothed.



Legs long and slender, with long dactyli furnished with hook-like teeth at the end of the posterior border: the 2nd pair of legs are nearly three times the length of the carapace.

A single male from Port Canning near Calcutta: its carapace is 8.5 millim. long and 6 millim. in its greatest breadth.

### Family GRAPSIDÆ Dana.

#### *Key to the Indian Genera.*

I. The antennules fold beneath the front in the ordinary way:—

1. No oblique hairy ridge on the exposed surface of the external maxillipeds:—

i. A very wide gap between the external maxillipeds, the exopodites of which appendages are narrow, and the palp of which appendages articulates at or near the antero-external angle of the merus: the abdomen of the male fills all the space between the last pair of ambulatory legs (*Grapsinae*):—

A. Front less than half the greatest breadth of the carapace: merus of the external maxillipeds longer than broad:—

a. Fingers with broad spooned tips: flagellum of exopodite of external maxillipeds well developed.

GRAPSUS.

b. Fingers acute, not spooned: flagellum of exopodite of external maxillipeds absent.....

GEGRAPSUS.

B. Front more than half the greatest breadth of the carapace: merus of the external maxillipeds broader than long:—

a. Antennæ completely excluded from the orbit.....

METOGRAPSUS.

b. Antennæ in the orbital hiatus...

PACHYGRAPSUS.

ii. A moderate gap between the external maxillipeds, the exopodites of which appendages are broad, and the palp of which appendages articulates near the middle of the anterior border of the broad merus: the abdomen of the male does not quite fill all the space between the last pair of legs (*Varuninae*):—

A. Exognath of the external maxillipeds not as broad as the ischiognath: terminal joints of legs thin based and compressed.....

VARUNA.

- B. Exognath of the external maxillipeds as broad as or broader than the ischiognath: dactyli of the legs compressed but not broadened:—
- a. Carapace flat and depressed . . . . . PTYCHOGNATHUS.
  - b. Carapace deepish, strongly convex in both directions . . . . . PYXIDOGNATHUS.
2. An oblique hairy ridge on the exposed surface of the external maxillipeds (*Sesarminæ*):—
- i. Carapace little, sometimes not at all, broader than long, the pterygostomian regions and sidewalls with a sieve-like reticulation: lower border of orbit not abnormally prominent:—
    - A. Antennæ lodged in the orbital hiatus:—
      - a. Carapace nearly square: front abruptly and vertically deflexed . . . . . SESARMA.
      - b. Antero-lateral borders of carapace arched: front obliquely deflexed . . . . . SARMATIUM.
    - B. The tooth at the inner angle of the lower border of the orbit meets the front, so as to exclude the antennæ from the orbit:—
      - a. Carapace dorsally smooth and nude . . . . . METASEARMA.
      - b. Carapace dorsally verrucose and densely tomentose . . . . . CLISTOCLEOMA.
  - ii. Carapace much broader than long, the pterygostomian regions, etc., not reticulated: lower border of orbit prominent beyond the front. Front gradually declivous. General appearance much like *Macrophthalmus* . . . . . METAPLAX.
- II. The antennules fold nearly longitudinally in deep notches in the front visible in a dorsal view (*Plagusinæ*):—
1. Merus of the external maxillipeds of good size and as broad as the ischium . . . . . PLAGUSIA.
  2. Merus of the external maxillipeds small and much narrower than the ischium . . . . . LILOPHUS.

### Sub-family GRAPSINÆ, Dana (pt.).

#### GRAPSUS, Lamk., Kingsley.

*Grapsus* (part) Lamark, Syst. Anim. Sans Vertèbr.: Latreille, Hist. Nat. Crust. et Ins. VI. p. 56, and Gen. Crust. p. 82.

*Grapsus*, Leach, Trans. Linn. Soc. XI. 1815, pp. 309, 328.

*Grapsus* (part) Desmarest, Consid. Gen. Crust., p. 129, and Dict. Sci. Nat. XXVIII. p. 247: Milne Edwards, Hist. Nat. Crust. II. 83, and Ann. Sci. Nat., Zool., (8) XX. 1853, p. 166: Dana, U. S. Expl. Exp. Crust. pt. I. p. 336.

*Grapsus*, Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 188 and 192: Miers, Challenger Brachyura, p. 254.

*Goniopsis*, De Haan, Faun. Japon. Crust. p. 33.

Carapace little broader than long, much depressed, the regions fairly well defined, the branchial groove particularly clear, the branchial regions with regular obliquely transverse ridges, the gastric region with a transverse squamiform sculpture. The lateral borders are arched and are armed with a tooth, placed immediately behind the acute outer orbital angle.

Front about half the breadth of the anterior border of the carapace, strongly deflexed: along the line of flexion are 4 tubercles, the outer of which on either side correspond with the supra orbital angles.

Orbits of moderate size, deep, distinctly divided into two fossæ: their lower border is deeply notched near the outer angle: the wide inner orbital hiatus is filled partly by the antennal peduncle and partly by a strong isolated tooth that belongs to the inner of the two fossæ into which the orbit is divided.

The antennules fold nearly transversely in rather narrow fossæ: the interantennular septum is very broad. The antennal flagellum is short, and lies practically in the orbital cavity: the excretory tubercle of the basal antenna-joint is singularly prominent.

Epistome of good length fore and aft, well defined; its wings run up towards the orbital hiatus. Buccal cavity square with the antero-lateral corners rounded off. The external maxillipeds are widely distant, leaving between them a rhomboidal gap in which the mandibles are exposed: the ischium and merus are both narrow, the merus being slightly shorter than the ischium, and the palp, which is coarse—especially as to its carpus—articulates at the antero-external angle of the merus.

Chelipeds subequal in both sexes and much shorter than the legs, though, in the male, of a somewhat stouter make: hands and fingers short and stout, the tips of the fingers broad and hollowed *en cuillère*.

Legs broad and compressed, especially as to the merus: the dorsal surface of some of the joints has a sort of reticulate or squamiform sculpture, and the dactyli are thorny.

The abdomen in both sexes consists of 7 segments, and in the male its base is as broad as the sternum between the last pair of legs.

*Distribution*: rocks and reefs of all the tropical and subtropical seas.

The *Grapsi* of Indian seas are found in considerable number wherever there are rocks. They live out of water and are very cunning and active: if they cannot succeed in dodging their pursuer they

fling themselves into the sea and in that way escape capture. Their colour in life is a dark bottle-green.

## 82. *Grapsus grapsus* (Linn.).

Seba, Thesaurus, III, p. 43, pl. xviii. figs. 5, 6.

*Cancer grapsus*, Linnæus, Syst. Nat. (ed. xii.) p. 1048: Fabricius, Ent. Syst. II. p. 488 and Suppl. p. 342.

*Grapsus maculatus* (Catesby, 1743), Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 167, pl. vi. fig. 1: Hoffmann, in Pollen and Van Dam, Faun. Madagasc., Crust., p. 21: Brocchi, Ann. Sci. Nat., Zool., (6) II. 1875, Art. 2, p. 78 (male appendages): Kingsley, Proc. Ac. Nat. Sci. Philad. 1879, p. 401, and 1880, p. 192: de Man, Notes Leyden Mus. V. 1883, p. 159: Miers, Zool. H. M. S. Alert, pp. 518, 544, and Challenger Brachyura, p. 255: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 236: R. I. Pocock, Journ. Linn. Soc., Zool., XX. 1890, p. 512: de Man, Notes Leyden Mus. XIII. 1891, p. 49: Koelbel, Ann. Nat. Hofmus. Wien, VII. 1892, p. 114: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 391: A. Milne Edwards and Bouvier, Hirondelle Crust. (Monaco, 1894) p. 47: de Man, Zool. Jahrb. Syst. IX. 1895-97, p. 79: Whitelegge, Mem. Austral. Mus. III. 1897, p. 139: Nobili, Boll. Mus. Torino, XII. 1897, p. 3. *Grapsus maculatus* var. *pharaonis*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 285.

*Grapsus pictus*, Latreille, Hist. Nat. Crust. et Ins. VI. p. 69, pl. xlvii. fig. 2, and Genera Crust. p. 33: Lamarck, Hist. Nat. Anim. Sans Vert. V. p. 248: Dumeril, Dict. Sci. Nat. XIX. p. 323: Desmarest, Consid. Gen. Crust. p. 130, pl. xvi. fig. 1: Milne Edwards, in Cuvier Règne An. pl. xxii. fig. 1, and Hist. Nat. Crust. II. 86: Milne Edwards and Lucas, Voy. Amer. Merid., Crust. p. 28: Gay, Hist. Fisica Chili, pt. III. Zool. p. 166: Dana, U. S. Expl. Exp. Crust. pt. I. p. 336: PDesbonne and Schramm, Crust. Guald. p. 49: Martens, Archiv f. Nat. XXXVIII. 1872, p. 106: Miers, Cat. Crust. New Zeal. p. 36, and P. Z. S. 1877, p. 73, and Phil. Trans. 1879, p. 489, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 310: Smith, Trans. Connect. Acad. IV. 1880, p. 256: Tenison Woods, Proc. Linn. Soc. N. S. W. V. 1880-81, p. 117: Osorio, Journ. Sc. Nat. Lisb. XI. 1885-87, p. 227. *Grapsus pictus* var. *ocellatus*, Studer, Abh. Ak. Berlin, 1882, Gazelle Crust. p. 14: *Grapsus pictus* var. *Webbi*, Hilgendorf, SB. Nat. Freunde Ges. 1882, p. 24.

*Grapsus ornatus*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 168.

*Grapsus pharaonis*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 168: Heller, SB. Ak. Wien, XLIII. 1861, i. p. 362: Hoffmann in Pollen and Van Dam, Faun. Madagasc. Crust. p. 20, pl. v. figs. 32-35: Richters, in Mobius, Meerest. Maurit. Crust. p. 156.

*Grapsus Webbi*, Milne Edwards, Ann. Sci. Nat. (3) XX. 1853, p. 167: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 102.

*Grapsus altifrons*, Stimpson, Ann. Lyc. Nat. Hist. N. Y. VII. 1862, p. 230.

*Grapsus grapsus*, Ives, Proc. Ac. Nat. Sci. Philad. 1891, p. 190: Ortman, Zool. Jahrb. Syst. VII. 1893-94, p. 703: Faxon, Mem. Mus. Comp. Zool., XVIII. 1895, p. 30: Rathbun, Proc. U. S. Nat. Mus. XXI. 1898, p. 604.

*Goniopsis picta*, De Haan, Faun. Japon. Crust. p. 33, and Krauss Sudaf. Crust. p. 46.

Carapace somewhat discoidal in shape, owing to the curvature of

the sides : its regions well defined : the transverse and oblique ridges are salient, and the surface between the latter is coarsely reticulate.

Front deep and almost vertically deflexed, overhanging the epistome and much concealing the antennules, its free edge crenate.

Length of the epistome one-third or more of its greatest breadth. The tooth at the inner angle of the orbit is blunt.

Chelipeds in the male hardly longer than the carapace, shorter in the female : inner border of ischium and arm strongly spinate, and there are one or two less acute spines at the far end of the outer border of the arm : wrist with fine scattered tubercles on its upper surface, and with its inner angle produced to form a talou-shaped spine : palm nearly as high as long, its outer surface sculptured, its upper border culminating in a tooth : the fingers have very broad rounded tips, and the length of the dactylus in the male is nearly twice the length of the upper border of the palm.

Of the legs the 1st pair are very decidedly the shortest and the 3rd pair the longest, the latter being about twice the length of the carapace : the 4th pair are longer than the first by a dactylus, and shorter than the 2nd by about two-thirds of a dactylus. Only in the last pair of legs does the breadth of the merus approach half the length of the same joint : the far end of the upper border of the merus is spine-like and there are usually 2 or 3 spines at the far end of the lower border.

In the Indian Museum are 18 specimens from the Laccadives, the Andamans, the Coromandel coast, and Ceylon. The carapace of a large specimen is 64 millim. long and 68 millim. broad.

### 83. *Grapsus strigosus* (Herbst).

*Cancer strigosus*, Herbst, Krabben, III. i. p. 55, pl. xlvii. fig. 7. *Grapsus strigosus*, Bosc, Hist. Nat. Crust. I. p. 203 : Latreille, Hist. Nat. Crust. et Ins., VI. p. 70, etc. : Milne Edwards, Hist. Nat. Crust. II. 87 : Gay, Hist. Fis. Chili, III. Zool. p. 168 : Dana, U. S. Expl. Exp. Crust. pt. I. p. 338 : Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 169 : Stimpson, Journ. Bost. Soc. Nat. Hist. VI. 1857. p. 466 : Kinahan, Journ. Roy. Soc. Dubl. I. 1858, p. 340 : Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 102 : Hess, Archiv f. Nat. XXXI. 1865, i. pp. 147, 171 : Heller, Novara Crust. p. 47 : A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71 and IX. 1873, p. 286 (*ubi synonym.*) : Hilgendorf in v. d. Decken's Reis. Ost-Afr. III. i. p. 87 : Hoffmann, in Pollen & Van Dam, Faun. Madag. Crust. p. 20, pl. v. fig. 31 : Lockington, Proc. Calif. Acad. VII. 1876, p. 151 : Kossmann, Reise roth. Meer., Crust. p. 60 : Miers, P. Z. S. 1877, p. 186, and Ann. Mag. Nat. Hist. (5) II. 1878, p. 410 : Hilgendorf, MB. Ak. Berl. 1878, p. 808 : E. Nauck, Zeits. Wiss., Zool. XXXIV. 1880, p. 32 (*gastric teeth*) : Kingsley, Proc. Ac. Nat. Sci. Philad. XXXII. 1880, p. 194 : Haaswell, Cat. Austral. Crust. p. 97 : Miers, Zool. H. M. S. Alert, pp. 518, 544, and Challenger Brachyura, p. 256 : Müller, Verh. Nat. Ges. Basel, VIII. p. 475 : de Man,

*Archiv f. Nat.* LIII. 1887, i. p. 365, and *Journ. Linn. Soc. Zool.* XXII. 1888, p. 148 : *Cano, Boll. Soc. Nap.* III. 1889, p. 236 : *Walker, Journ. Linn. Soc., Zool.*, XX. 1886—1890, p. 110 : *Henderson, Trans. Linn. Soc., Zool.*, (2) V. 1893, p. 390 : *de Man, Zool. Jahrb. Syst.* IX. 1895—97, p. 80 : *Ortmann, Zool. Jahrb., Syst.*, 1893—94, p. 705 : *Wedenissow, Bull. Soc. Ent. Ital.* 1894, p. 415.

*Grapsus albo-lineatus*, Lamarck, *Hist. Nat. Anim. Sans Vert.* V. p. 249 (*vide Edw.*).

*Goniopsis flavipes*, Macleay, *Ill. Ann. S. Africa*, p. 66, and *Krauss, Sudafr. Crust.* p. 46 (*apud Miers*).

*Goniopsis strigosa*, De Haan, *Faun. Jap. Crust.* p. 33 : *Macleay, loc. cit.* : *Krauss, loc. cit.*

*Grapsus granulatus, pelagicus*, and *Peroni*, *Milne Edwards, Ann. Sci. Nat.* (3) XX. 1853, p. 169 (*vide A. M. E.*).

The chief differences between this species and *G. grapsus* are the following:—

The branchial grooves of the carapace are not so well cut, the transverse and oblique ridges are low and smooth, and the surface between the oblique ridges is quite smooth.

The front is not so deep and is obliquely deflexed, hardly overhanging the epistome and not concealing the antennules, and its free edge is not so distinctly crenulate. The tooth at the inner angle of the orbit is subacute. The length of the epistome is not nearly a third its greatest breadth.

In the chelipeds, the tooth at the inner angle of the wrist is nearly straight, not talon-like, the length of the upper border of the palm is nearly two-thirds the length of the dactylus, and the tips of the fingers are not so broad and blunt.

In the legs the meropodite is broader, its greatest breadth being half its length. Moreover the difference in size between the 1st and 4th pairs of legs is much less marked.

In the Indian Museum are 76 specimens, from the Baluchistan and Sind coast, the Malabar coast, Ceylon, the Coromandel coast, the Arakan and Tenasserim coast, Mergui, the Andamans, and the Nicobars.

The carapace of the largest specimen (a female) is 59 millim. long and 63 millim. broad.

#### GEOGRAPSUS, Stimpson.

*Geograpsus*, Stimpson, *Proc. Ac. Nat. Sci. Philad.* 1858, p. 101 : *Kingsley, Proc. Ac. Nat. Sci. Philad.* 1880, pp. 188, 195 : *Miers, Challenger Brachyura*, p. 260.

*Orthograpsus*, *Kingsley, l. c.* pp. 188, 194.

Closely resembles *Grapsus*, but differs in the following important particulars:—

The carapace is more quadrate, the sides being very little arched, it is also broader and less depressed. The lobe at the inner inferior

angle of the orbit is not so completely isolated. The antennal peduncle is not so massive, nor is its "urinary tubercle" conspicuous. The epistome is shorter fore and aft, and is much less well defined.

The chelipeds are altogether of a different type, being vastly more massive than the legs, and in the adult male at least as long as the longest legs: the fingers are pointed. Though the dactyli of the legs are thorny, they are not so closely covered with thorns, nor are the thorns so coarse, as in *Grapsus*. Between the coxæ of the 2nd and 3rd pair of legs is a narrow fossa fringed with hair leading to the branchial cavity.

The two Indian species of the genus are land-crabs and are found in the jungles of the Andaman and Nicobar islands and in the villages of the Laccadive islands. They are extremely vigilant and active.

#### 84. *Geograpsus Grayi* (Edw.).

*Grapsus Grayi*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 170.

*Geograpsus rubidus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 103.

*Geograpsus Grayi*, A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 288; Miers, Phil. Trans. 1879, p. 489, and Zool. H. M. S. Alert, pp. 518, 545, and Challenger Brachyura, p. 261; Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 196; Richters, in Mobius, Meeresf. Maurit. p. 156; Haswell, Cat. Austral. Crust. p. 98; Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 707; de Man, Zool. Jahrb., Syst. IX. 1895-96, p. 80; Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 266.

Carapace subquadrilateral, a little convex, the lateral borders well defined anteriorly, ill defined and slightly convergent posteriorly: transverse markings fine, curved or oblique on the branchial regions, almost invisible on the gastric region.

The four tubercles along the line of flexion of the front are not salient; the edge of the front in a dorsal view is concave. The notch near the outer end of the lower border of the orbit is small and narrow. The epistome is rather ill defined.

Chelipeds in both sexes a little unequal: squamiform markings are present but, except on the arm, are indistinct, as also are the scattered granules on the upper surface of the palm. The larger cheliped may be a little under or a little over twice the length of the carapace. The inner border of the ischium is denticulate, the inner border of the arm is expanded to form a dentate lobe, and the inner angle of the wrist is spiniform.

The greatest breadth of the meropodites of the legs is less than half their length. The first pair of legs are slightly shorter than the 4th: the 2nd pair are the longest of all, being about twice the length of the carapace. The last 3 joints of all the legs are bristly.

Colours in life yellow-ochre, the greater part of the dorsum of the carapace livid bluish or purplish.

In the Indian Museum are 24 specimens from the Andamans, Nicobars, and Laccadives.

The carapace of a large male is 40 millim. long and 49 broad.

#### 85. *Geograpsus crinipes* (Dana).

*Grapsus crinipes*, Dana, Proc. Ac. Nat. Sci. Philad. 1851, p. 249, and U. S. Expl. Exp. Crust., pt. I. p. 341, pl. xvi. fig. 6.

*Geograpsus crinipes*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 101.; Heller, Novara Crust. p. 48; Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 115; Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 196; Ortmann, Zool. Jahrb., Syst. VII. 1893-94, p. 706; de Man, Zool. Jahrb., Syst. IX. 1895-97, p. 83; Whitelegge, Mem. Austral. Mus. III. 1897, p. 139.

*Grapsus rubidus*, Hilgendorf, in v. d. Decken's Reisen Ost-Afr. Crust., p. 87, pl. v.: Hoffmann, in Pollen & Van Dam, Faun. Madagasc. Crust. p. 22.

Differs from *G. Grayi* in the following particulars:—

The carapace is quite flat, and the lateral borders, which are thin and well defined throughout their extent, are slightly *divergent* posteriorly: the transverse markings are distinct and *nearly straight*.

The four tubercles along the line of flexion of the front are salient, and the free edge of the front is quite straight. The notch near the outer end of the lower border of the orbit is large, and the lobule external to the notch is denticulate. The epistome is well defined from the palate by a granular or pectinate ridge.

The chelipeds in the male are nearly equal, but in the *female* they are unequal. The squamiform markings on the arm, wrist, and lower portion of the hand are distinct, as also are the vesiculous granules on the upper surface of the palm and dactylus.

The greatest breadth—near the far end—of the meropodites of the last 3 pairs of legs is *more than half* their length.

Colour in life bright red.

In the Indian Museum are 2 males and a female from the Andamans, a male from the Nicobars, and a female from the Laccadives. The carapace of a female is 40 millim. long and 45 broad.

#### METOPOGRAPSUS, Edw.

*Metopograpsus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1858, p. 164; Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 188, 190; Miers, Challenger Brachyura, p. 257.

Carapace quadrate, little broader than long, somewhat depressed, the regions not well defined, the branchial groove distinct, fine oblique



grooves are present on the lateral parts of the branchial regions: the antero-lateral, or outer orbital angle, is acute, but there are no teeth on the lateral border behind it.

Front very broad, more than half the extreme width of the carapace, deflexed: along the line of flexion are four depressed lobes, the outer one of which on either side sometimes shows a tendency to split into two.

Orbits of moderate size, occupying the corners of the carapace: the lower border is notched near its outer end: the orbital hiatus is filled by a special lobe which belongs to the inner of the two fossæ into which the orbit is divided and this lobe completely excludes the antennæ from the orbit. The antennules fold nearly transversely in fossæ of good size. The antennæ have a short and slender flagellum: the basal joint of the peduncle is not very massive.

Epistome well defined, but short fore and aft. Buccal cavity square with the anterior corners rounded off. The external maxillipeds leave between them a rhomboidal gap in which the mandibles are exposed: the merus is shorter than the ischium, and carries the coarse palp at or near the antero-external angle.

Chelipeds either subequal or unequal, the larger one much more massive than the legs but shorter than the 2nd and 3rd pairs of these: fingers rather short and stout, with the tip spooned.

Legs broad and compressed, especially as to the merus, which joint—like the arm of the chelipeds—usually has some squamiform markings: the last three joints have bristly edges and the dactylus is thorny.

The abdomen in both sexes consists of 7 separate segments, and in the male its base is as broad as the sternum between the last pair of legs.

An Indo-Pacific genus.

#### 86. *Metopograpsus messor* (Forsk.) Edw.

*Cancer messor*, Forskal, Descrip. Anim. in itin. orient. p. 88. *Grapsus messor*, Milne Edwards, Hist. Nat. Crust. II. 88: Krauss, Sudafr. Crust. p. 43: Hoffmann in Pollen & Van Dam, Faun. Madag. Crust. p. 23: Sluiter, Tijds. Nederl. Ind. XL. 1881, p. 164. *Metopograpsus messor*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 165: Heller, SB. Ak. Wien, XLIII. 1861, p. 363, and Novara Crust. p. 44: A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71: Kossmann, Reise roth. Meer., Crust. p. 57: Hilgendorf, MB. Ak. Berl. 1878, p. 808: Miers, Phil. Trans. 1879, p. 489, and Zool. H. M. S. Alert, pp. 184, 245, 518, 545, and Challenger Brachyura, p. 258: de Man, Notes Leyden Mus. II. 1880, p. 183, and Journ. Linn. Soc. Zool. XXII. 1887-1888, p. 144, pl. ix. fig. 11, and Archiv f. Naturges. LIII. 1888, i. p. 361, pl. xv. fig. 6, and in Weber's Zool. Ergebn. Niederl. Ost. Ind. II. p. 314:

Richters, in Mobius, Meeresf. Maurit. p. 156: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 190: Lenz & Richters, Abh. Senck. Nat. Ges. XII. 1881, p. 425: Müller, Verh. Nat. Ges. Basel, VIII. p. 475: Ozorio, Journ. Sci. Nat. Lisb. XI. p. 227: Henderson, Trans. Linn. Soc., Zool., (2) V, 1893, p. 390: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 701: Whitelegge, Mem. Austral. Mus. III. 1897, p. 139: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 265.

*Grapsus Gaimardi*, Savigny, Descr. Egypt. Crust. pl. ii. fig. 3.

*Metopograpsus Bydouzi* and *intermedius*, Milne Edwards, Ann. Sci. Nat., Zool., (2) XX. 1853, p. 165 (*sec.* Kingsley, *l.c.*).

*Pachygrapsus ethiopicus*, Hilgendorf, in v. d. Decken, Reisen Ost-Afr., Crust. p. 88, pl. iv. fig. 2 (*vide* Kossmann, *l.c.*, and Hilgendorf, *l.c.*).

Carapace about four-fifths as long as broad, the sides distinctly convergent posteriorly; besides the oblique markings on the lateral parts of the epibranchial regions, there are some fine transverse markings on the post-frontal region.

Front about three-fifths the greatest breadth of the carapace, its free edge beaded, thin and prominent but hardly laminar, and slightly sinuous. Orbits little oblique, their major diameter is a little more than a third the width of the front: the inner angle of the lower border is denticulate.

Chelipeds unequal, the length of the larger one about  $1\frac{1}{2}$  times that of the carapace: there are wrinkles or squamiform markings on the upper surface of the arm and wrist and—along with some vesiculous granules—on the upper and lower borders of the hand. The inner border of the ischium is denticulate, the inner border of the arm is spinate and is expanded distally to form a lacinate lobe, and there is a spine, which may be double, at the inner angle of the wrist: the fingers have blunt tips, and the dactylus is not very much longer than the upper border of the palm.

Of the legs the 1st pair is the smallest and the 3rd pair the longest—about twice the length of the carapace: in all, the upper border of the merus ends in a spine and the lobe at the far end of the lower border is spinate: in the last three pairs the greatest breadth of the merus is half its length.

The terminal segment of the male abdomen is simply triangular.

In the Indian Museum are 56 specimens, from Karachi, Bombay, the Orissa coast, the Ganges Delta, the Arakan coast, and the Andamans. The carapace of the largest specimen is  $23\frac{1}{2}$  millim. long and 30 millim. broad.

#### 87. *Metopograpsus maculatus*, Edw.

*Metopograpsus maculatus*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 165: de Man, Journ. Linn. Soc., Zool., XXII. 1887-88, p. 145, pl. x. figs. 1-8.

Distinguished from the only other Indian species by the following characters:—

The carapace is much more elongate, its length being seven-eighths of its breadth, its sides are very markedly convergent posteriorly, and there are no transverse markings on the post-frontal region.

The front is nearly three-fourths the greatest breadth of the carapace, and its free edge is decidedly laminar and nearly straight.

The orbits are oblique: their major diameter is less than a third the breadth of the front and the inner angle of their lower border is not denticulate.

The fingers of the chela, though their tips are spooned, are not very blunt: the dactylus is much longer than the upper border of the palps.

Except perhaps in the last pair of legs, the meropodites are narrower, their greatest breadth being decidedly less than half their length.

In the male abdomen the terminal segment has a somewhat three-lobed appearance.

In the Indian Museum are two specimens from Mergui. It seems to me very doubtful whether they are distinct from *M. latifrons*, White (Jukes, Voy "Fly," II. 337, pl. ii. fig. 2).

#### PACHYGRAPSUS, Randall, Stimpson.

*Pachygrapsus*, Randall, Proc. Ac. Nat. Sci. Philad. 1889, p. 126: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 166: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 101: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 188, 198: Miers, Challenger Brachyura, p. 259.

Differs from *Metopograpsus* only in the following particulars:—

(1) the tooth or lobe at the inner angle of the lower border of the orbit is small and does not fill the orbital hiatus, so that the antennæ are not excluded from the orbit; (2) there may be a tooth or two on the lateral border of the carapace immediately behind the outer orbital angle.

*Distribution*: West Indies eastwards, through the Mediterranean, to the American Pacific coast.

#### 88. *Pachygrapsus minutus*, A. M. Edw.

*Pachygrapsus minutus*, A. Milne Edwards, Nouv. Archiv. de Mus. IX. 1873, p. 292, pl. xiv. fig. 2: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 201: de Man, Notes Leyden Mus. V. 1883, p. 153, and Archiv f. Naturges. LIII. 1887, i. p. 298, and Journ. Linn. Soc., Zool., XXII. 1888, p. 148: Cano, Boll. Soc. Nat. Napol. III. 1889, p. 240.

Carapace a good deal broader than long, its whole dorsal surface marked with fine transverse and oblique lines: the lateral borders are

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strongly convergent posteriorly, and have no spine behind the acute outer orbital angle.

Front about three-fifths the greatest breadth of the carapace, moderately deflexed, its free edge slightly sinuous. Orbits little oblique, their major diameter more than a third the breadth of the front, their lower border not denticulate.

The chelipeds in the male are subequal and vastly more massive than the legs, and are about twice the length of the carapace, and, except for some squamiform markings on the arm, are smooth: the inner border of the ischium and both borders of the arm are crenulate, and the distal end of the inner border of the arm is expanded to form a denticulate lobe: the inner angle of the wrist is dentiform: the fingers are stout and blunt.

Of the legs the two middle pairs are the longest, being not twice the length of the carapace. In all the last three joints are bristly, and the merus has a spine at the far end of the anterior border and two largish spines at the far end of the posterior border.

The terminal joint of the male abdomen is simply triangular.

A small species: the carapace of the single specimen (from Mergui) in the Indian Museum is 6.5 millim. long and 10 millim. broad.

#### Subfamily VARUNINÆ.

VARUNA, Edw.

*Varuna*, Milne Edwards, Dict. Hist. Nat. XVI. p. 511 (1830), and Hist. Nat. Crust. II. 94, and Ann. Sci. Nat. Zool., (3) XX. 1853, p. 176: Kingsley, Proc. Ac. Nat. Sci. Philad. 1890, pp. 188, 205: Miers, Challenger Brachyura, p. 265.

*Trichopus*, De Haan, Faun. Japon. Crust. p. 32.

Carapace very little broader than long, depressed, with thin sharp edges, the regions fairly well indicated. Front a little more than half the breadth of the anterior border and a little more than a third the greatest breadth of the carapace, straight, prominent, sublaminar, little deflexed. Antero-lateral borders of the carapace arched, cut into 3 teeth including the outer orbital angle.

Orbits small, of good depth, their lower border broken and incomplete. The antennules fold obliquely and the interantennular septum is broad. Antennæ of fair size, standing in the orbital hiatus.

Epistome of good length, well defined. Buccal cavern square. The external maxillipeds gape, but not very widely: their exognath is not nearly as broad as the ischium: their merus is shorter, but anteriorly much broader, than the ischium, its antero-external angle being considerably produced, so that the palp articulates near the middle of the anterior border.

Chelipeds equal, but variable in size. In old males they are considerably longer, and vastly more massive, than the legs: in the female they are shorter, and though stouter are not vastly stouter than the legs. The fingers, though sharp pointed, are a little hollow-tipped.

The legs have the three terminal joints compressed, dilated, and plumed, for swimming: the 2 middle pairs are the longest, the last pair is the shortest.

The abdomen in both sexes consists of 7 separate segments: in the male it does not completely cover the sternum between the last pair of legs.

*Distributed* throughout the Indo-Pacific, ascending estuaries even into freshwater. Commonly found at sea on drift logs.

### 89. *Varuna litterata* (Fabr.) Edw.

*Cancer litteratus*, Fabricius, Ent. Syst. Suppl. p. 342: Herbst, Krabben, III. i. 58, pl. xlvi. fig. 4.

*Grapsus litteratus*, Boec, Hist. Nat. Crust. I. p. 208, and Latreille, Hist. Nat. Crust. et Ins. VI. p. 71.

*Varuna litterata*, Milne Edwards, Dict. d'Hist. Nat. XVI. p. 511.

*Trichopus litteratus*, De Haan, Faun. Japon. Crust. p. 32: Dana, U. S. Expl. Exp. Crust. pt. I. p. 336, pl. xx. fig. 8.

*Varuna litterata*, Milne Edwards, Hist. Nat. Crust. II. p. 95, and Ann. Sci. Nat. Zool., (3) XX. 1858, p. 176: Lucas, Hist. Nat. Anim. Artic., Crust., p. 72, pl. iii. fig. 4: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 103: Heller, Novara Crust. p. 51, A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71, and IX. 1873, p. 295: Brocchi, Ann. Sci. Nat. (6) II. 1875, (*male appendages*): Miers, Cat. Crust. New Zealand, p. 40, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 310, and Challenger Brachyura, p. 265: Tozzetti, Magenta Crust. p. 122, pl. viii. figs. 2 a-g: Hilgendorf, MB. Ak. Berl. 1878, p. 808: Neumann, Crust. Heidelb. Mus., p. 27: Nauck, Zeits. Wiss. Zool. XXXIV. 1890, p. 29 (*gastric teeth*): Kingsley, Proc. Ac. Nat. Sci. Philad. 1890, p. 205: Sluiter, Tijds. Nederl. Ind. XL. 1881, p. 164: Haswell, Cat. Austral. Crust. p. 103: Filhol, Crust. Nouv. Zel. in Miss. Pile Campbell, p. 390: de Man, Archiv fur Nat. LIII. 1887, i. p. 371, and in Weber's Zool. Ergebn. Niederl. Ost. Ind. II. 1892, p. 315, and Zool. Jahrb., Syst. IX. 1895, p. 112: Henderson, Trans. Zool. Soc. (2) V. 1898, p. 391: Ortmann, Zool. Jahrb. Syst., VII. 1893-94, p. 713: Max Weber, Zool. Jahrb. Syst. X. 1898, p. 157: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 267.

Carapace curiously pitted and frosted above, the regions well enough defined by grooves, which in places are broad shallow and uneven; the disposition of these grooves in the middle of the carapace makes a letter H. The borders of the carapace are thin and are sharply defined and finely beaded or milled: the antero-lateral borders are arched and are cut into three teeth, including the outer orbital angle: the postero-lateral boundary of the carapace, on each side, is a distinct facet.

The chelipeds vary, according to sex and age, from a little over once (in the female) to a little over twice (in old males) the length of the carapace. The borders of the arm are denticulated, especially the inner border; the inner angle of the wrist forms a large sharp spine with some spinules at its base; the inner surface of the palm is more or less granular, the outer surface has some fine reticulate markings and—running parallel with the lower border, on to the fixed finger—a raised line: the fingers are stout and strongly toothed, the dactylus being longer than the upper border of the palm.

The 2nd and 3rd pair of legs, which are about equal, are over  $1\frac{1}{2}$  times the length of the carapace: the 1st pair are a little more than a dactyl-length, the 4th pair a little less than a dactyl-length longer than the carapace. The only armature of the legs, which are typical swimming paddles, is a subterminal spine on the anterior border of the meropodite.

In the Indian Museum are 63 specimens from the seas of India. The carapace of the largest male is 50 millim. long and 56 millim. broad.

#### PTYCHOGNATHUS, Stimpson.

*Ptychognathus*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1868, p. 104; Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 188, 203; de Man, Zool. Jahrb., Syst., IX. 1895, p. 90. *Gnathogrepsus*, A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 180. *Golochirus*, Nauck, Zeits. Wiss. Zool. XXXIV. 1890, pp. 30, 68 (*teste* de Man).

Very closely resembles *Varuna*, from which it differs only in the following particulars:—

(1) the exopodite of the external maxillipeds is of remarkable breadth, being at least as broad as, and usually much broader than, the ischium of those appendages:

(2) the regions of the carapace are not always so well defined.

(3) the dactyli of the legs, though compressed, are not so broad.

*Distribution*: Islands of the Indo-Pacific, entering fresh water above any tidal influence.

#### *Key to the Indian species of Ptychognathus.*

I. Carapace hardly broader than long: front prominent, straight or hardly sinuous: the antennules fold very obliquely:—

1. Teeth of the antero-lateral border sharp and salient: regions of the carapace fairly well defined: fingers of the female chelae nude:—

i. Inner angle of the wrist dentiform, but not produced: a large shaggy patch of hairs on the inner surface of the hand of the male... *P. dentata*.

- ii. Inner angle of the wrist produced to form a long spine: a patch of hair on the outer surface of the hand of the male, near the finger cleft..... *P. mys.*
- 2. Teeth of the antero-lateral border not salient, inconspicuous: regions of the carapace not, or hardly, indicated:—
  - i. A subterminal patch of bristles on the outer surface of the fixed finger of the female..... *P. andamanica.*
  - ii. Fingers of female nude ..... *P. pusilla.*
- II. Carapace decidedly broader than long: front little prominent and decidedly sinuous: the antennules fold nearly transversely..... *P. barbata.*

90. *Ptychognathus dentata*, de Man.

*Ptychognathus dentatus*, de Man, in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 318, pl. xviii. fig. 9.

Carapace inappreciably broader than long, flat but not particularly depressed, its regions quite distinct, as also are the cervical and branchial grooves and a pair of post-frontal tubercles: on the posterior part of each epibranchial region, obliquely parallel with the postero-lateral borders, is a fine ridge.

Front prominent, laminar, nearly straight, its extent is two-fifths the greatest breadth of the carapace.

Antero-lateral borders of the carapace cut into three sharp salient teeth, of which the first is much the largest, and the third much the smallest.

Upper border of the orbit very sinuous. The antennules fold very obliquely. Anterior border of the buccal cavern not granular, but having a median horizontal tooth.

Exognath oval, with a smooth and strongly convex surface: its greatest breadth in the male is more than twice that of the ischiognath, but in the female is only a little more than that of the ischiognath.

Chelipeds of the male more than  $1\frac{1}{2}$  times the length of the carapace, smooth: inner angle of the wrist acute, but not spiniform: palm higher than long, inflated at the postero-inferior angle, and having a tussock of hairs in the middle of its inner surface: dactylus more than twice the length of the upper border of the palm, longer slenderer and less strongly toothed than the fixed finger: both fingers though hollowed at the tip are sharp-pointed. In the female the chelipeds are about as long as the carapace; the inner angle of the wrist is spiniform; the palm is not swollen and is nude, and its outer surface is traversed, near the lower border, by a fine raised line which extends nearly to the tip of the fixed finger.

The 2nd and 3rd pairs of legs are about  $1\frac{1}{2}$  times, the 1st pair are not quite  $1\frac{1}{2}$  times, and the 4th pair are not  $1\frac{1}{2}$  times, the length of the carapace: on the anterior border of the merus of the first three pairs is a subterminal spine.

The sidewall of the carapace and the basal joints of the legs have little tomentum.

In the Indian Museum are 2 males and an egg-laden female from "the Bay of Bengal" and 2 young females from Upper Tenasserim.

The carapace of the largest male is 19 millim. long and not quite 20 millim. in its greatest breadth.

#### 91. *Ptychognathus onyx*, n. sp.

Very closely related to *P. spinicarpus*, Ortm., and to *P. Polleni* and *afinis*, de M., if these species are distinct.

This species very nearly resembles *P. dentata*, from which it differs, young males being compared with females of the same size, only in the following particulars:—

(1) the carapace though otherwise similar is much thinner and more depressed and its markings are not quite so distinct:

(2) in the middle of the anterior border of the buccal cavern is a slight prominence, but no distinct tooth:

(3) the exognath (*in the young male*) is, as in the female of *P. dentata*, but little broader than the ischiognath:

(4) in the chelipeds of the young male the inner angle of the wrist is produced to form a long spine; there is no hair on the inner surface of the palm, but on the outer surface, in the finger-cleft and extending along the fixed finger, there is a tuft of hair; the outer surface of the palm also, as in the female of *P. dentata*, is traversed, close to the lower border, by a raised line, which runs to the tip of the fixed finger; finally the fingers are blunter, and the dactylus is only about twice as long as the upper border of the palm.

Practically the chief distinction between this species and *P. dentata* is that in the male of this species the inner angle of the wrist forms a long spine, and the hair is on the outside instead of on the inside of the hand.

In the Indian Museum are two young males probably from Tavoy. The carapace is a little over 12 millim. long and 13 millim. broad.

#### 92. *Ptychognathus andamanica*, n. sp.

Closely related to *P. pusilla*, of which it may be an Andaman variety.

Carapace not much broader than long, quite flat, much depressed, the regions are hardly indicated, even when the carapace is quite dry,



but the H-shaped mark in the middle is always plainly visible, the whole surface is closely and finely punctate: there are no post-frontal tubercles, but on the posterior part of either epibranchial region there is a fine line running obliquely-parallel with the postero-lateral borders.

Front prominent, laminar, slightly sinuous, its extent is two-fifths the greatest breadth of the carapace.

The antero-lateral borders are cut into 3 not very acute or distinct lobes (including the outer orbital angle), of which the first is much the largest, and the last much the smallest.

Upper border of the orbit slightly sinuous: the antennules fold very obliquely. The anterior border of the buccal cavern is granular and a little concave.

The exognath is long and elliptical; its breadth in the female, is nearly twice that of the ischiognath.

The chelipeds in the female (male unknown) are about as long as the carapace, and their outer surface is very finely reticulate-granular: inner angle of wrist pronounced, but not spiniform: palm without hair, but there is a characteristic brush of stiffish hair at the tip of the fixed finger on its outer surface. The fingers have broad tips, especially the fixed finger, which is stouter and more strongly toothed than the dactylus: the dactylus is about twice as long as the upper border of the palm: the outer surface of the palm and fixed finger is traversed, near the lower border, by a fine raised granular line.

The legs have not much tomentum on the basal joints, but the anterior border of the meropodites is rather thickly fringed: the subterminal denticle on the anterior border of the meropodites is small, blunt, inconspicuous, or obsolescent. The 2nd and 3rd pair of legs, which are the longest, are about  $1\frac{1}{2}$  times, the 1st pair are not  $1\frac{1}{4}$  times, and the 4th pair are little more than once, the length of the carapace.

In the Indian Museum are two young females from a freshwater stream at the base of Saddle Hill in North Andaman Island. Their colour is dark mottled green. The carapace is a little over 13 millim. long and about 14 millim. broad.

### 93. *Ptychognathus pusilla*, Heller.

*Ptychognathus pusillus*, Heller, Novara Crust. p. 60: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880. p. 204: de Man, Notes Leyden Mus. V. 1883, p. 161, and Zool. Jahrb. Syst. IV. 1888-89, p. 440, and in Weber's, Zool. Ergebn. Niederl. Ost-Ind. II. p. 325, and Zool. Jahrb. Syst. IX. 1895, p. 99, and X. 1898, pl. xxviii. fig. 22: Ortmanu, Zool. Jahrb., Syst. VII. 1893-94, p. 712.

This species, which was first found in the Nicobar Islands, is not represented in the Museum collection and I have never seen it.

94. *Ptychognathus barbata* (A. M. Edw.).

*Gnathograpsus barbatus*, A. Milne Edwards, Nonv. Archiv. du Mus. IX. 1873, p. 316, pl. xvii. fig. 4.

*Ptychognathus barbatus*, Ortmann, Zool. Jahrb. Syst. VII, 1893-94, p. 712: de Man, Zool. Jahrb., Syst., IX. 1895, p. 105.

Carapace decidedly broader than long, flat, depressed, the regions indistinct: the two postfrontal tubercles are fairly distinct, but there is no distinct raised line on the posterior part of the epibranchial regions, running obliquely parallel with the posterior borders, such as is present in all the other Indian species. There is a good deal of tomentum on the sides of the carapace.

Front decidedly sinuous, not prominent, its extent is a little more than two-fifths the greatest breadth of the carapace.

The antero-lateral borders of the carapace are cut into 3 not very conspicuous teeth (including the outer orbital angle) of which the first is much the largest and the third much the smallest, as usual.

Upper border of the orbit little sinuous: the antennules fold nearly transversely. Anterior border of the buccal cavern finely granular.

The exognath is elliptical, with a slightly convex surface: in the male its greatest breadth is more than that of the ischiognath, in the female it is slightly narrower than in the male.

Chelipeds in the male about  $1\frac{2}{3}$  times the length of the carapace, the inner angle of the wrist little pronounced; the hand massive, with a tuft of hair in the finger-cleft and running some little distance along the outer surface of both fingers; the fingers are rather blunt, the dactylus, which is about twice the length of the upper border of the palm is longer slenderer and less strongly toothed than the fixed finger, against which it closes rather obliquely. In the female the chelipeds are about as long as the carapace and are not very massive, the inner angle of the wrist is dentiform, there is no hair on the hand or fingers, and the outer surface of the hand and fixed finger is traversed near the lower border by a raised line.

The leg-joints are less expanded and less abundantly plumed than in the other Indian species, and there is no subterminal spine on the anterior border of the meropodites. The 2nd and 3rd pairs of legs are about  $1\frac{1}{2}$  times, the 1st pair about  $1\frac{1}{2}$  times, and the last pair a little over once, the length of the carapace.

In the Indian Museum are 3 specimens from Diamond Island off the Pegu coast and from Akyab, (besides numerous specimens from Samoa). The carapace of an apparently adult male is 11 millim. long and 14 millim. broad.

## PYXIDOGNATHUS, A. M. Edw.

*Pyxidognathus*, A. Milne Edwards, Bull. Soc. Philom. Paris (7) III. 1878, p. 109; de Man, Notes Leyden Mus. V. 1883, p. 160, and Journ. Linn. Soc., Zool., XXII. 1888, p. 148.

*Hypsilograpsus*, de Man, Notes Leyden Mus. I. 1879, p. 72 (*ipso teste*).

This genus is closely related to *Varuna* and *Ptychognathus*. It differs from *Varuna* in the same particulars that *Ptychognathus* does, that is to say, the exognath of the external maxillipeds is much broader than the ischiognath, and the dactyli of the legs though compressed are not dilated. It further differs, both from *Varuna* and *Ptychognathus* in the following characters:—

(1) the carapace is decidedly transverse, is deep, and is dorsally strongly convex in both directions: it is also anteriorly declivous with the front deflexed, and its antero-lateral borders are hardly arched:

(2) the antennules fold transversely:

(3) the lower border of the orbit is complete, except of course at the orbital hiatus:

(4) the carpopodites and propodites of the legs are not particularly broad.

*Distribution*: Indo-Pacific in fresh or brackish water.

*Key to the Indian species of Pyxidognathus.*

- |                                                                                      |                        |
|--------------------------------------------------------------------------------------|------------------------|
| I. A single spine on the posterior border of the meropodites of the legs .....       | <i>P. fluviatilis.</i> |
| II. More than one spine on the posterior border of the meropodites of the legs ..... | <i>P. deianira.</i>    |

95. *Pyxidognathus deianira*, de Man.

*Pyxidognathus deianira*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 148, pl. x. figs. 4-6.

Carapace about  $\frac{3}{4}$  as long as broad, convex, smooth, without distinction of regions excepting a faintish H-shaped mark in the middle. Free edge of front sinuous or four-lobed, as in the next species.

Antero-lateral borders of the carapace cut into three prominent acute teeth (including the outer orbital angle), the first of which is the largest, and the last of which is spine-like.

Upper border of orbit slightly sinuous, lower border finely denticulate.

Exognath of the external maxillipeds, in the male, very much broader than the ischiognath, and having a smooth convex surface.

Chelipeds in the young male about  $1\frac{1}{2}$  times the length of the carapace: inner border of ischium, arm, and wrist denticulate; inner angle of

wrist spiniform; the upper border of the palm is granulate, a finely beaded raised line traverses the lower part of the outer surface of the palm and fixed finger, and there is a very short series of granules near the middle of the inner surface of the palm: the palm is nearly as high as long, and the dactylus is much longer than the upper border of the palm and closes against the fixed finger by the tip only.

The 2nd pair of legs, which are the longest, are not much short of twice the length of the carapace; the 4th pair, which are the shortest, are but little longer than the carapace. In all the legs, the meropodite has some fine rugosities on its upper surface, a spine near the far end of the anterior border, and some spines on the posterior border—these being most numerous in the case of the 4th pair of legs: and in all, the edges of the 3 terminal joints are hairy but not plumose, nor are these joints broadened or compressed.

In the Indian Museum are two very small male specimens from Mergui.

96. *Pyxidognathus fluviatilis*, n. sp.

Carapace transverse, markedly convex, finely punctate, the regions indicated only by an H-shaped mark in its centre.

Front between two-fifths and a third the greatest breadth of the carapace, deflexed, sinuous or four-lobed, the two middle lobes broad, the outer lobes (= inner orbital angles) subacute.

Antero-lateral borders of the carapace slightly arched, cut into three prominent acute teeth (including the outer orbital angle) of which the first is the largest and least acute, and the third is spine-like.

Orbits of good depth, the upper border slightly sinuous, the lower border defined by a granular ridge running close behind the prominent denticulated ridge that bounds the infra-orbital region of the carapace.

Anterior border of buccal cavern prominent, finely crenulate. Exognath in the female broader than the ischiognath, and having a smooth convex surface.

Chelipeds in the female about as long as the carapace, more massive than the legs: inner angle of wrist acuminate: a raised line runs along the outer surface of the palm and fixed finger, close to the lower border: fingers rather sharp though spooned at tip, dactylus hardly twice the length of the upper border of the palm, longer and rather less strongly toothed than the fixed finger.

All the leg-joints are plumed, and all the dactyli are long compressed and recurved. In all the legs there is a very strong spine in the distal

half of the posterior border of the meropodite, and in the first 3 pairs there is a smaller subterminal spine on the anterior border of the same joint. The 2nd and 3rd pairs of legs are about  $1\frac{1}{2}$  times, the 1st pair are not quite  $1\frac{1}{2}$  times, and the 4th pair are about  $1\frac{1}{4}$  times the length of the carapace.

Colour mottled dark green. A single female was found clinging to the floats of a fisherman's net in the R. Ichamutty above Bongong in the Jessore District: its carapace is 15 millim. long and 19 millim. broad.

The legs are obviously adapted for swimming, and the recurved dactyli and spiny meropodites appear to be adaptations to a swift current.

The chief difference between this species and *P. deianira*—the female of the former being compared with the male of the latter—is that in this species the three terminal joints of the legs are more compressed and the posterior border of the meropodites is armed with a single spine.

#### Sub-family SESARMINÆ, Dana.

##### SESARMA, Say.

*Sesarma*, Say, Journ. Acad. Nat. Sci. Philad. I. 1817, p. 76: Milne Edwards, Hist. Nat. Crust. II. 71, and Ann. Sci. Nat. Zool. (3) XX. 1853, p. 181: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 301: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 213: Miers, Challenger Brachyura, p. 269: de Man, Zool. Jahrb., Syst., II. 1886-87, p. 641 and IX. 1895-97, p. 128: Bürger, Zool. Jahrb., Syst., VII, 1893-94, p. 618.

*Pachysoma*, De Haan, Faun. Japon. Crust., p. 83.

*Holometopus*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 187.

Carapace squarish or actually square (the sides being straight and usually nearly parallel), usually deep (though occasionally shallow and much depressed), seldom very convex: the gastric region is almost always very well delimited, and is commonly divided into 5 subregions, and in most cases the 4 antero-lateral subregions project as 4 prominent post-frontal tubercles.

The side-walls of the carapace have everywhere a characteristic fine-meshed reticulate texture as regular as that of a sieve. This appearance is due to a multitude of small uniform granules arranged in pairs in close-set parallel rows: between each pair of granules is a little row of bristles, one of which in each row is long and points diagonally forwards.

The front occupies half, or more, of the anterior border of the carapace, and is obliquely or vertically deflexed.

The orbits, which occupy the rest of the anterior border of the carapace, are oval and of good depth: below their outer angle is a deepish gap leading into a system of grooves which open into a notch at the antero-lateral angle of the buccal cavern. At the inner angle of the orbit is the usual tooth, belonging to the inner of the two fossæ into which (as in all the crabs of this subfamily) the orbit is so plainly divided. The eyes are of no great length.

The antennules fold nearly transversely into rather narrow fossæ: the inter-antennular septum is very broad.

The antero-external angle of the 2nd joint of the antennal peduncle is a good deal produced: the antennal flagellum, which is slender and rather short, lies in the orbital hiatus.

Epistome well defined, prominent, rather short fore and aft. Buccal cavern square. The external maxillipeds leave between them a large rhomboidal gap, which is a good deal filled up by a hairy fringe: they are obliquely traversed, from a point behind the antero-external angle of the ischium to the antero-internal angle of the merus, by a conspicuous line or crest of hairs: the palp, which is rather coarse, is attached to the rounded summit of the obliquely-directed merus.

Chelipeds massive—not always so in the female—usually subequal, of no great length: palm high and short, the fingers though subacute, are hollowed at the tip.

The legs do not usually differ very markedly in length, though the third pair are the longest and the first and last (4th) pairs the shortest: the meropodites are thin, and are usually, but not always, broad.

The abdomen in both sexes consists of 7 separate segments: in the male it occupies the whole breadth of the sternum between the bases of the last pair of legs. In both sexes the second segment, as well as the exposed portion of the first, are narrow fore and aft. In the female the last segment is small and narrow from side to side, and is more or less impacted in the broad 6th segment: in the male also the last segment is much narrower than the one that precedes it.

*Distribution*: all tropical and subtropical seas: not found in the Mediterranean.

I am not inclined to adopt the subgenera proposed by Dr. de Man, although I must admit that his system is convenient in practice, for identifying species.

I may also mention here that specific distinctions based merely on the sculpture of the dactylus of the male chelæ are inadmissible, as the sculpturing frequently differs in the two fingers of the same individual.

*Key to the Indian species of Sesarma.*

- I. Carapace deepish, its length decidedly less than its breadth between the antero-lateral angles, its sides nearly parallel—never markedly divergent posteriorly :—
1. The inner border of the arm bears, near its far end, a large acute tooth : on the upper surface of the palm of the male are at least two characteristic *oblique* comb-like ridges : the upper surface of the movable finger of the male is milled :—
    - i. Posterior border of the meropodites of the legs entire :—
      - a. No tooth on the lateral border of the carapace behind the orbital angle :—
        - a. Front more than half the extent of the anterior border of the carapace..... *S. quadratum.*
        - β. Front exactly half the extent of the anterior border of the carapace..... *S. pictum.*
      - b. A tooth on the lateral border of the carapace, behind the orbital angle ..... *S. bidens.*
    - ii. Distal end of the posterior border of the meropodites of the legs acutely serrate (no tooth behind the outer orbital angle)... ..... *S. Andersoni.*
  2. The inner border of the arm does not end in a large spine or acute lobe, though it may be a little dilated distally : there are no oblique pectinated ridges on the upper surface of the palm, and the upper surface of the movable finger of the male though it may be granular is not milled :—
    - i. A tooth at the inner angle of the wrist (a tooth on the lateral border of the carapace behind the orbital angle) :—
      - a. The breadth of the carapace between the antero-lateral angles is equal to, or more than, the breadth between the epibranchial teeth..... *S. Edwardsi.*
      - b. The breadth of the carapace between the antero-lateral angles is decidedly less than the breadth between the epibranchial teeth, the sides of the carapace being markedly sinuous..... *S. Meinerti.*
    - ii. No spine at the inner angle of the wrist :—
      - a. Carapace and appendages not uniformly tomentose : two acute teeth—the second of which is hardly visible—on the lateral border, behind the acute orbital angle..... *S. intermedium.*

- b. Carapace and appendages covered with a short but very dense fur, amid which are prominent tubercle-like tufts of hair: lateral borders cut into three blunt lobes (including the orbital angle) of equal size..... *S. lanatum.*
- II. Carapace nearly square, its length being little less than its breadth between the antero-lateral angles: the inner border of the arm ends in an acute serrated lobe: a very finely pectinated ridge traverses the upper surface of the palm, fore and aft, close to the upper border: (a tooth on the lateral border of the carapace behind the orbital angle):—
1. Carapace deep, its sides nearly parallel: a transverse granular ridge on the inner surface of the palm: dactyli of the legs of good length:—
    - i. Upper border of movable finger of male with an elegantly milled crest of 40 to 60 fine lamellæ..... *S. tæniolatum.*
    - ii. Upper border of movable finger of male with a coarsely crenulate crest..... *S. tetragonum.*
  2. Carapace shallow and depressed, its sides divergent posteriorly: no transverse granular crest on the inner surface of the palm: dactyli of the legs short: (a milled crest of about 25 very fine lamellæ on the upper border of the movable finger of the male)..... *S. Brockii.*
- III. Carapace somewhat elongate (its length being decidedly more than its breadth at the antero-lateral angles), shallow and depressed:—
1. No tooth on the lateral border of the carapace behind the orbital angle: legs with remarkably broad meropodite and remarkably short propodite: upper border of movable finger of male with an elegantly milled crest of about 40 fine lamellæ ..... *S. latifemur.*
  2. Two teeth on the lateral border behind the orbital angle: movable finger without any milling:—
    - i. Post-frontal tubercles of the gastric region serrated: legs with meropodites of good breadth and dactyli of good length..... *S. politum.*
    - ii. Post-frontal tubercles smooth: legs with rather narrow meropodites and short dactyli..... *S. oceanicum.*
- IV. The length of the carapace is just equal to its breadth at the antero-lateral angles: legs long and slender, with elongate dactyli:—
1. Carapace shallow, depressed, perfectly square, its sides quite parallel: two little teeth on the lateral border behind the orbital angle..... *S. Finni.*
  2. Carapace deepish, its sides strongly divergent posteriorly where its breadth is much greater than its length: two teeth (not including the orbital angle)



on the lateral border, the posterior one being very small :—

- i. Third pair of legs not three times the length of the carapace..... *S. longipes.*
- ii. Third pair of legs more than three-and-a-half times the length of the carapace..... *S. kraussi.*

97. *Sesarma quadratum* (Fabr.).

*Cancer quadratus*, Fabricius, Ent. Syst. Suppl. p. 341.

*Ocypoda quadrata*, Bosc, Hist. Nat. Crust. I. p. 198.

*Ocypoda plicata*, Latreille, Hist. Nat. Crust. &c. VI. p. 47.

*Sesarma quadrata*, Milne Edwards, Hist. Nat. Crust. II. 75, and Ann. Sci. Nat., Zool., (3) XX. 1853, p. 183.

*Sesarma quadratum*, A. Milne Edwards, Nonv. Archiv. du Mus. IX. 1873, p. 302 : Miers, Phil. Trans. Vol. 168, 1879, p. 490.

*Sesarma quadrata*, Richters, in Mobius' Meeresf. Maurit. p. 157 : Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 217 : Lenz and Richters, Abh. Senck. Nat. Ges. XII. 188, p. 425 : de Man, Zool. Jahrb. Syst. II. 1887, p. 655, pl. xvii. fig. 2 and p. 683, and IV. 1889, p. 434, and IX. 1895-97, pp. 181, 182, and Notes Leyden Mus. XII. 1890, p. 99, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. p. 328 : Thallwitz, Abh. Mus. Dresden, 1890-91, No. 3, p. 37 : Henderson, Trans. Linn. Soc. Zool., (2) V. 1893, p. 392 : Ortman, Zool. Jahrb. Syst. VII. 1893-94, p. 724.

*Grapsus (Pachysoma) affinis*, De Haan, Faun. Jap. p. 66, pl. xviii. fig. 5.

*Sesarma affinis*, Krauss, Sudafr. Crust. p. 45 : Milne Edwards, Ann. Sci. Nat. Zool. (3) XX., 1853, p. 183 : Heller, Novara Crust. p. 62 : de Man, Notes Leyden Mus. II. 1880, p. 22 : Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 312 : Kingsley, *l.c. supra*, p. 213 : Ortman, *l.c. supra*, p. 724.

*Sesarma unguolata* : Milne Edwards, Ann. Sci. Nat., Zool. (3) XX. 1853, p. 184 : Kingsley, *l.c. supra*, p. 218.

*Sesarma aspera*, Heller, Novara Crust. p. 63, pl. vi. fig. 1 : Kingsley, *l.c. supra*, p. 214 : Müller, Verh. Nat. Ges. Basel, 1886, p. 476 : de Man, Zool. Jahrb. II. 1887, p. 656 and Journ. Linn. Soc. Zool. XXII. 1887-88, p. 169.

*Sesarma melissa*, de Man, Zool. Jahrb. Syst., II. 1887, p. 656, and Journ. Linn. Soc., Zool., XXII. 1888, p. 170, pl. xii. figs. 5-7, and Zool. Jahrb. Syst., IV. 1889, p. 434.

Carapace hardly convex, decidedly broader than long, its length being about four-fifths its breadth between the antero-lateral angles, deep ; the 4 post-frontal lobes prominent equal and a little rugose transversely, the rugæ being sparsely tufted with hair ; the cardiac and intestinal regions very much less distinct than the gastric : some oblique striations on the epibranchial regions.

Front decidedly more than half the greatest breadth of the carapace, not very deep, its free margin usually but slightly sinuous. Lateral borders of carapace nearly parallel, a little divergent anteriorly, without any tooth behind the acute orbital angle.

The chelipeds differ in the sexes, being about  $1\frac{1}{2}$  times the length

of the carapace in the male and much more massive than the legs, but in the female hardly  $1\frac{1}{3}$  times the length of the carapace and not more massive than the legs. In both sexes the outer surface of the arm wrist and palm are granular, the granules on the arm and wrist having a squamiform arrangement, the inner border of the arm bears a subterminal spine of large size, the upper border of the arm ending in a much smaller spine, the inner angle of the wrist is not dentiform, and the inner surface of the palm is more or less granular. In the male the palm is a little swollen below and has, on its upper surface, some short oblique crests, of which two are most elegantly pectinated: in the female the palm is not swollen and the crests are simply granular. The dactylus is less than twice the length of the upper border of the hand (palm) and its dorsal surface is elegantly milled with from 11 to 19 blunt, rather coarse, transverse lamellæ: in the female this milling is incomplete and very indistinct. In neither sex is there any great gap between the closed fingers.

The meropodites of the legs are foliaceous, their greatest breadth in the 2nd and 3rd pairs being more than half their length, their anterior border ends at an acute subterminal spine, and their dorsal surface has some fine transverse squamiform sculpture. The anterior border of the last three joints of the legs, and part of the posterior border of the last two, is fringed with tufts of bristles. The 3rd pair of legs, which are slightly the longest, are about twice the length of the carapace, and their dactylus is about three-fourths the length of their propodite.

In the Indian Museum are 42 specimens from both coasts of the Peninsula, Ceylon, the Andamans and the Nicobars.

In a male of good size the carapace is 16 millim. long and 20 millim. broad.

#### 98. *Sesarma pictum*, De Haan.

*Grapsus (Pachysoma) pictus*, De Haan, Faun. Japon. Crust. p. 61, pl. xvi. fig. 6.

*Sesarma picta*, Krauss, Sudafr. Crust. p. 45: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 184: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 106: de Man, Notes Leyden Mus. II. 1880, p. 22, and Zool. Jahrb., Syst., II. 1887, p. 657, and IX. 1895-97, pp. 181, 182, and Journ. Linn. Soc., Zool., XXII. 1888, p. 171: Bürger, Zool. Jahrb., Syst., VII. 1893-94, p. 626: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 725.

Agrees with *S. quadratum* in everything but the following particulars:—

(1) the carapace is not so broad, its length being about five-sixths of its breadth between the antero-lateral angles:

(2) the front is not so broad, its extent being only half the breadth of the carapace :

(3) the meropodites of the legs are not so broadly foliaceous, their greatest breadth, in the middle two pairs, being less than half their length.

The Indian Museum possesses a single specimen from Mergui.

### 99. *Sesarma bidens* (De Haan).

*Grapsus* (*Pachysoma*) *bidens*, De Haan, Faun. Japon. Crust. p. 60, pl. xvi. fig. 4, and pl. xi. fig. 4.

*Sesarma bidens*, Dana, U. S. Expl. Exp. Crust. pt. I. p. 353: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 185: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 105: Heller, Novara Crust. p. 64: Hilgendorf, in v. d. Decken's Reisen Ost-Afr., Crust., p. 91, pl. iii. fig. 3a: Hoffmann, in Pollen & Van Dam, Faun. Madag. Crust. p. 24: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 313, and Zool. H. M. S. Alert, pp. 184, 246: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 214: de Man, Notes Leyden Mus. II. 1880, p. 28, and Zool. Jahrb., Syst., II. 1887, p. 658, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. p. 330: Lenz & Richters, Abh. Senck. Nat. Ges. XII. 1881, p. 425: Bürger, Zool. Jahrb., Syst., VII. 1893-94, p. 628: Ortmann, *ibid.* p. 726: Nobili, Ann. Mus. Genova (2) XX. 1899, p. 269.

*Sesarma Dussumieri*, Milne Edwards, *l. c. supra*: Tozzetti "Magenta" Crust. p. 145, pl. ix. figs. 3 a-f: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 215: de Man, Zool. Jahrb. Syst. II. 1887, p. 659, and IX. 1895-97, p. 206, and Journ. Linn. Soc., Zool., XXII. 1888, p. 177, pl. xii. figs. 8-12: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 726.

*Sesarma lividum*, A. Milne Edwards, Nouv. Archiv. du Mus., V. 1869, Bull. p. 25, and IX. 1873, p. 303, pl. xvi. fig. 2: Brocchi, Ann. Sci. Nat., Zool., (6) II. 1875, Art. 2, p. 83 (*male appendages*): Kingsley, *tom. cit. supra*, p. 216: de Man, Archiv. f. Naturges. LIII. 1887, i. p. 381, pl. xvii. fig. 1, and Zool. Jahrb. Syst. II. 1887, p. 659, and Journ. Linn. Soc., Zool., XXII. 1888, p. 180.

*Sesarma Haswelli*, de Man, Zool. Jahrb., Syst., II. 1887, p. 658, and Journ. Linn. Soc., Zool., XXII. 1888, p. 175.

This species very closely resembles *S. quadratum*, from which it differs in the following characters:—

(1) there is a small sharp tooth on the lateral border of the carapace, immediately behind the outer orbital angle:

(2) the carapace is slightly less transverse (though decidedly broader than long):

(3) the transverse ridges on the upper surface of the dactylus of the male chelæ are coarser and shorter and more tubercle-like.

In the Indian Museum are 52 specimens from the coasts of the Bay of Bengal, Andamans, Nicobars and Ceylon.

100. *Sesarma Edwardsi*, de Man.

*Sesarma Edwardsi*, de Man, Zool. Jahrb., Syst., II. 1887, p. 649, and Journ. Linn. Soc., Zool., XXII. 1888, p. 185, pl. xiii. figs. 1-4: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 721.

Differs from *S. quadratum* in the following particulars:—

(1) the carapace is squarer and less transverse, and the four post-frontal lobes of the gastric region are more prominent; the front also is slightly, but distinctly, broader:

(3) there is a sharp tooth on the lateral border of the carapace immediately behind the antero-lateral angle:

(3) the upper border of the arm does not end in a spine, and though there may be a slight subterminal dilatation of the crenulated inner border of the arm there is *no large spine*:

(4) there is a *sharp tooth or spine just below the inner angle of the wrist*:

(5) the upper surface of the wrist and outer surface of the palm are covered—usually very closely covered—with vesiculous tubercles; and there are smaller and sharper tubercles on the upper surface of the dactylus and the lower surface of the fixed finger of the chelæ:

(6) there are no oblique pectinated crests on the palm:

(7) *the male abdomen is singularly broad*.

In the Indian Museum are 126 specimens, most of which came from the Burma coast from Arakan to Tavoy, the rest from the Gangetic delta, the Andamans and Ceylon.

In the variety separated by de Man as *crassimana* the abdomen is not quite so broad as it is in the typical form, and the palm of the male is larger and more swollen.

101. *Sesarma intermedium* (De Haan).

*Grapus (Pachysoma) intermedium*, De Haan, Faun. Japon. Crust. p. 61, pl. xvi. fig. 5.

*Sesarma intermedia*, Milne Edwards, Ann. Sci. Nat., Zool., (9) XX. 1858, p. 186: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 105: Heller, Novara Crust. p. 64: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 216: Miers, Ann. Mag. Nat. Hist. (5) V. 1880, p. 314: de Man, Notes Leyden Mus. II. 1880, p. 25, and Zool. Jahrb., Syst., II, 1887, p. 649, and Journ. Linn. Soc., Zool., XXII. 1888, p. 182: Ortmann, Zool. Jahrb. Syst. VII. 1893-94, p. 721.

Differs from *S. quadratum* in the following particulars:—

(1) the carapace is more quadrate and less transverse, the post-frontal lobes are less prominent and much smoother, and the front is broader:

(2) there is a tooth—and sometimes also a second rudimentary tooth—on the lateral border immediately behind the orbital angle:

(3) there is no large subterminal spine on the inner border of the arm, nor does the upper border end in a spine :

(4) in the corner of the upper surface of the palm there are in the male some oblique granular lines, but no pectinated crests ; and on the inner surface of the palm there is a conspicuous transverse granular crest :

(5) the upper surface of the dactylus of the male chelæ is granular in its proximal half, but is not milled with transverse lamellæ.

From *S. Edwardsi* it is distinguished by numerous characters, but the absence of a spine at the inner angle of the wrist is sufficiently characteristic.

In the Indian Museum are 5 specimens from Mergui.

#### 102. *Sesarma Meinerti*, de Man.

*Sesarma Meinerti*, de Man, Zool. Jahrb., Syst., II. 1887, pp. 648, 668, and IX. 1895-97, p. 166 : Bürger, Zool. Jahrb. Syst. VII. 1893-94, p. 617, and Ortman, *ibid.* p. 720.

*Sesarma tetragona*, Edw. (*nec* Fabr.), Milne Edwards, Hist. Nat. Crust. II. 73, and Ann. Sci. Nat., Zool., (3) XX. 1853, p. 184 : A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71, and IX. 1873, p. 304, pl. xvi. fig. 4 : Hilgendorf, in v. d. Decken's Reisen Ost-Afr., Crust. p. 90 : Hoffmann, in Pollen & Van Dam, Faun. Madag. Crust. p. 23 : Hilgendorf, MB. Ak. Berl. 1878, p. 809 : Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 218.

Carapace convex, especially fore and aft, a little broader than long, deep : the 4 post-frontal lobes prominent, unequal—the outer ones being much narrower than the middle pair ; the cardiac and intestinal regions are quite distinct, and the usual oblique striations are found on the epibranchial regions : the whole dorsal surface of the carapace is rather profusely covered with tufts of hair.

Front decidedly more than half the greatest breadth of the carapace, which is just behind the orbital angles, not very deep, its free edge sinuous. Lateral borders of the carapace somewhat sinuous, armed with a large tooth behind the orbital angle : there may even be a trace of a second epibranchial tooth.

Chelipeds subequal, almost equally massive in both sexes, about twice as long as the carapace. The outer surface of the arm and wrist is finely rugose, that of the palm is only pitted : neither the upper nor the inner border of the arm end in a tooth : inner angle of wrist pronounced but not dentiform : no pectinated crests of any kind on the palm : the fingers are a good deal arched and meet only at tip, the upper surface of the dactylus in the male has a row of inconspicuous denticles : on the inner surface of the palm there is an oblique granular crest.

The meropodites of the legs are foliaceous, but their breadth is not twice their length; but otherwise the legs are as in *S. quadratum*.

The abdomen of the male is decidedly narrow.

In the Indian Museum are 26 specimens from the Andamans and one from Madras. The carapace of a large one is 33 millim. long and 38 millim. broad: in the female the carapace is not so broad.

103. *Sesarma Andersoni*, de Man.

*Sesarma Andersoni*, de Man, Zool. Jahrb., Syst., II. 1887, p. 657, and Journ. Linn. Soc. Zool. XXII. 1888, p. 172, pl. xii. figs. 1-4.

Carapace moderately deep, hardly convex, considerably broader than long, the four post-frontal lobes of the gastric region only moderately prominent, nearly equal, pitted; the cardiac and intestinal regions faintly indicated; the oblique striations of the epibranchial regions very sharp and distinct, one of them almost projects beyond the lateral border as a tooth behind the orbital angle.

Front more than half the greatest breadth of the carapace, not very deep, its free margin a little convex but nearly straight. The lateral borders of the carapace are slightly convergent posteriorly: except for the afore-mentioned projection of the first branchial ridge there is no tooth behind the orbital angle.

Chelipeds much larger in the male than in the female, but the difference is not so marked as in *S. quadratum*. The inner border of the arm ends in a very acute denticulated lobe: the palm is traversed on the outer surface, near the lower border, by a fine raised line, and on the upper surface in the male are numerous short parallel oblique striæ one of which at least is most elegantly pectinate: in the female these crests are less numerous and less distinct: the upper surface of the dactylus of the male is milled, the lamellæ increasing in size and coarseness from behind forwards.

*At the distal end of the posterior border of the meropodites of the legs are three or four strong spines, decreasing in size from behind forwards, but there is no subterminal spine on the anterior border: in other respects, except that the dactyli are slightly shorter, the legs are very similar to those of S. quadratum. The male abdomen is broad.*

In the Indian Museum are 8 specimens from Mergui: the carapace of the largest is 7 millim. long and 9 millim. broad.

104. *Sesarma lanatum*, n. sp.

Carapace deepish, dorsally flat, everywhere covered, as also are the appendages, with a dense fur amid which are freely scattered little dense

adherent tufts of hair resembling tubercles. When this covering is removed the surface of the carapace is smooth and polished, with the gastric region and its four post-frontal tubercles distinct.

The length of the carapace is considerably less than its breadth between the antero-lateral angles.

Front a little more than half the breadth of the carapace, obliquely deflexed, its free margin nearly straight. The lateral borders of the carapace are nearly parallel and anteriorly are cut into three blunt lobes of nearly equal size—including the outer orbital angle.

The chelipeds when denuded have a smooth surface and sharp borders: they are similar in the two sexes, except that they are much more massive in the male. There is a blunt angular projection at the far end of the inner border of the arm, the inner angle of the wrist is pronounced but not dentiform, and the upper border of the palm is traversed fore and aft by a fine sharp crest: in the male the palm is at least as high as long: the upper border of the dactylus is faintly crenulate in its proximal two-thirds.

The meropodites of the legs are foliaceous, but their breadth is less than half their length: their borders are entire. The dactyli of the legs are claw-like, their length being about three-fourths that of the propodites.

The abdomen of the male is narrow.

In the Indian Museum are 4 specimens from Bombay and Karachi: the carapace of the largest is  $8\frac{1}{2}$  millim. long and 10 millim. broad.

#### 105. *Sesarma tæniolatum*, White.

*Sesarma tæniolatum*, White, List Crust. Brit. Mus. p. 38 (1847): Miers, P. Z. S. 1877, p. 137, and Ann. Mag. Nat. Hist. (5) V. 1880, p. 313: de Man, Notes Leyden Mus. II. 1880, p. 26: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 218: de Man, Zool. Jahrb., Syst., II. 1887, pp. 647, 666, and IX. 1895-97, p. 166, and Journ. Linn. Soc., Zool., XXII. 1888, p. 181, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. p. 330: Bürger, Zool. Jahrb., Syst., VII. 1893-94, p. 615, and Ortmann, *ibid.* p. 720.

*Sesarma Mederi*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 185: Tozzetti, "Magenta" Crust. p. 136, pl. ix. figs. 1 a-i.

Carapace deep, nearly flat dorsally, square, its length being slightly less than its breadth between the antero-lateral angles. All the regions are quite well defined, and the 4 post-frontal tubercles—the middle two of which are not very much broader than the outer ones—are very prominent. The whole dorsum of the carapace is covered with tufts of hair, which are largest and longest anteriorly. There are some oblique striæ on the sides of the epibranchial regions.

Front half, or a little more than half, the breadth of the carapace,

not very deep, its free margin strongly sinuous. Lateral borders of the carapace nearly parallel, armed with one acute tooth behind the acute outer orbital angle.

The chelipeds are similar in the two sexes, except that they are a good deal more massive and more sharply sculptured in the male. They are not quite twice the length of the carapace: the outer surface of the arm and wrist are granular-rugose, the outer surface of the palm is granular, and there is a transverse granular ridge on the inner surface of the palm: the upper border of the arm is crest-like and ends in a sharp tooth, and the distal end of the inner border forms an acute angular serrate lobe: the inner angle of the wrist is dentiform: close to and nearly parallel with the upper border of the palm runs a fine and very finely and evenly pectinate crest: along the upper border of the dactylus runs a very elegantly milled crest of from 40 to 60 fine teeth. In the male the palm is at least as high as long, the fingers meet only at tip, and the dactylus is about twice the length of the upper border of the palm.

The meropodites of the legs are foliaceous, but their greatest breadth is not quite half their length: there is a sharp subterminal spine on their anterior border only. The dactyli of the legs are two-thirds, or more, the length of the propodites. The 3rd pair of legs, which are the longest, are a little more than twice the length of the carapace.

In the Indian Museum are 9 specimens, from Mergui, the Andamans, and Penang. The carapace of a large specimen is nearly 38 millim. long and nearly 40 broad.

#### 106. *Sesarma tetragonum* (Fabr.).

*Cancer tetragonus*, Fabricius, Ent. Syst., Suppl. p. 341.

*Cancer fascicularis*, Herbst, Krabben etc. III. i. 49, pl. xlvii. fig. 5.

*Sesarma tetragona*, de Man, Zool. Jahrb., Syst., II. 1887, p. 646; Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 392.

This species closely resembles *S. tæniolutum*, from which it differs in the following characters:—

- (1) the carapace is slightly broader:
- (2) the subterminal lobe of the inner border of the arm is smaller, while the tooth at the inner angle of the wrist is more pronounced:
- (3) the fine striated crest along the upper border of the palm is shorter:
- (4) the crest of the upper surface of the movable finger of the chelæ is coarsely crenulate.



In the Indian Museum are 8 specimens from Ceylon, Madras, the Mahanaddi Delta, and the Ganges Delta. The carapace of a large one is 40 millim. long and 43 millim. broad.

107. *Sesarma Brockii*, de Man.

*Sesarma Brockii*, de Man, Zool. Jahrb., Syst., 1887, p. 651, and IX. 1895-97, p. 171, and Archiv f. Naturges. LIII. 1887, i. p. 373, pl. xvi. fig. 3: Thallwitz, Abhand. Zool. Mus. Dresden, 1890-91, No. 3, p. 39: Ortman, Zool. Jahrb., Syst., VII. 1893-94, p. 721.

Resembles *S. tæniolatum*, but differs in the following characters:—

(1) the carapace is *shallow* and much depressed, its length is just equal to its breadth between the antero-lateral angles, its dorsal surface is not so hairy, and its sculpture though similar is not so deeply cut: the front is not so sinuous.

(2) the lateral borders of the carapace are *slightly divergent* posteriorly, and there are *two* teeth—the posterior of which is, however, extremely small—behind the outer orbital angle:

(3) no subterminal spine on the upper border of the arm: no transverse granular crest on the inner surface of the palm:

(4) the milled crest along the upper border of the dactylus of the chelæ is lower and has only about 25 teeth:

(5) the legs are longer, their meropodites are narrower and their dactyli—except in the case of the 1st pair of legs—are *barely half the length of their propodites*.

In the Indian Museum there is a young male from the Andamans. In this specimen the chelipeds are not massive and are very little longer than the carapace.

108. *Sesarma latifemur*, n. sp.

Closely related to *S. elongatum*, A. M. Edw.

This species belongs to the same natural group as *S. tæniolatum*, from which it differs only in the following characters:—

(1) the carapace is *shallow* and much depressed, and its length is decidedly *more* than its breadth between the antero-lateral angles, its dorsal surface is not quite so hairy and its post-frontal lobes are deeper cut:

(2) the lateral borders of the carapace are decidedly *divergent* posteriorly and have no tooth behind the orbital angle:

(3) the male chelipeds are little longer than the carapace: the crest-like upper border of the arm does not end in a spine: the inner

angle of the wrist, though well pronounced, is not spiniform: the transverse beaded ridge on the inner surface of the palm is very short:

(4) the dactylus of the chelæ is not nearly twice the length of the upper border of the palm, and the milled crest on its upper surface consists of not more than 40 teeth:

(5) the meropodites of the legs are remarkably foliaceous, their greatest breadth, in the case of the 2nd and 3rd pairs, being more than half their length: all the leg joints are thinner and flatter:

(6) the dactyli of the legs are remarkably short, their length, in the case of the 2nd and 3rd pairs, being *less than half* the length of their propodites.

In the Indian Museum is a single male from the Andamans: its carapace is nearly 35 millim. long, and a little over 30 millim. broad across the antero-lateral angles.

#### 109. *Sesarma politum*, de Man.

*Sesarma polita*, de Man, Zool. Jahrb. Syst. II. 1887, p. 654: Journ. Linn. Soc., Zool., XXII. 1888, p. 189, pl. xiii. figs. 7-9.

Carapace shallow and much depressed, a good deal longer than broad, all the regions well defined: the four post-frontal lobes of the gastric subregions are deep-cut and very prominent, their anterior overhanging edges are serrated and their surface bears some transversely arranged sharpish tubercles: the two middle lobes are decidedly larger than the outer ones. There are no oblique striæ on the epibranchial regions.

Front more than half the breadth of the carapace, its free margin markedly sinuous. The lateral borders of the carapace are nearly parallel though slightly sinuous: there are two well cut teeth behind the outer orbital angle.

Chelipeds equal, and not so very much longer than the carapace: the outer surface of the arm wrist and hand are closely beset with small tubercles, which in places have a squamiform look, and the inner surface of the palm is granular but has no transverse ridge: the inner and outer borders of the arm, the inner border of the wrist, and the upper border of the palm and movable finger are conspicuously serrulate, and there is also a noticeable dilatation near the far end of the inner border of the arm. There are no pectinated crests of any sort on the palm, and the fingers—both surfaces of which are smooth and polished—have no large gap between them when closed.

The legs are shortish, the 3rd pair being hardly  $1\frac{1}{2}$  times the length

of the carapace, and rather slender. The meropodites are nearly three times as long as broad, they have a subterminal spine on the anterior border and in the case of the 1st pair their posterior border is distinctly serrulate. The dactyli are rather short, their length, in the third pair, being less than two-thirds the length of the propodite: they are remarkably tomentose.

In the Indian Museum there is a single specimen from Mergui: its carapace is 38 millim. long and 35 millim. broad.

110. *Sesarma oceanicum*, de Man.

*Sesarma oceanica*, de Man, Zool. Jahrb., Syst., IV. 1889, p. 429, pl. x. fig. 9, and Notes Leyden Mus. XIII. 1891, p. 52.

Carapace shallow, depressed, its length greater than its breadth between the antero-lateral angles; all the regions are fairly well defined and the 4 post-frontal lobes of the gastric subregions are prominent, the middle pair being more than twice as broad as the two outer ones: the surface of the carapace is granular anteriorly and punctate posteriorly, and near the sides are numerous short oblique striæ.

Front half the breadth of the carapace, deepish, its free margin a little sinuous: orbits not at all oblique: the lateral borders of the carapace have a slight, but distinct, convex curve, and there are two teeth—the posterior of which is extremely small—behind the outer orbital angle.

Chelipeds equal, not much longer than the carapace: the outer surface of the arm and wrist are rugose and both surfaces of the palm are studded with sharpish granules: there is a small angular lobe near the far end of the inner border of the arm, and the inner angle of the wrist is dentiform: the palm is not quite as high as long, close to and nearly parallel with its upper border is a fine and finely granular ridge: the dactylus is about half as long again as the upper border of the palm, and there are some sharpish granules along its upper surface.

The legs are slender: their meropodites are more than three times as long as broad and are not foliaceous, they have a subterminal spine on the anterior border only: their dactyli are shortish, those of the 3rd pair being less than two-thirds the length of their propodites, and are densely plumed: the 3rd pair of legs are about  $2\frac{1}{2}$  times the length of the carapace.

In the Indian Museum is a single specimen from the Nicobars: its carapace is 20 millim. long, and 16.5 millim. across the antero-lateral angles.

111. *Sesarma Finni*, n. sp.

Near *S. maculata*, de Man.

Carapace shallow, depressed, flat, perfectly square, its length being equal to its breadth at the antero-lateral angles and its sides being parallel: the regions are indicated, but not emphasized, and the 4 post-frontal lobes are sharply prominent, the middle pair being much broader than the outer ones.

Front half the breadth of the carapace, deepish, its free edge nearly straight: two little teeth on the lateral border of the carapace, behind the outer orbital angle.

In the chelipeds of the female the outer surface of the arm wrist and hand are granular; the upper border of the arm ends acutely, and the inner border ends in a spine; the inner angle of the wrist is pronounced, but is not dentiform; and the upper surface of the palm is traversed, fore and aft, close to the upper border, by a fine and finely milled ridge.

Legs long and slender, the 3rd pair being more than  $2\frac{1}{2}$  times the length of the carapace: their meropodites are not foliaceous, being about three times as long as broad, and they have a subterminal spinule on the anterior border only: their dactyli are long and slender, those of the 3rd pair being more than three-fourths the length of the propodite: the propodites and dactyli of all the legs are fringed with short stiff sharp bristles.

The species is represented by a small female from the Andamans: its carapace is not quite 11 millim. in either diameter.

112. *Sesarma longipes*, Krauss.

*Sesarma longipes*, Krauss, Sudafr. Crust. p. 44, pl. iii. fig. 2: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 199: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 216: de Man, Zool. Jahrb., Syst., II. 1887, p. 651.

The length of the carapace is equal to its breadth at the antero-lateral angles, but as the lateral borders of the carapace diverge considerably, from before backwards, the *greatest* breadth of the carapace (at the level of the 2nd pair of legs) is considerably more than the length.

Carapace deepish, very slightly convex; its regions are not very well defined, but the median longitudinal groove of the gastric region is deep, and the 4 post-frontal lobes are sharply prominent, the middle pair being much broader than the outer ones.

Front half the extent of the anterior border of the carapace, the free margin slightly sinuous: the divergent lateral borders of the carapace have a tooth of good size behind the outer orbital angles.

Chelipeds in the female not half as long again as the carapace : the outer surface of the arm and wrist are rugulose, and both surfaces of the palm are studded with sharpish granules : the upper border of the arm ends acutely, but there is no spine at the end of the inner border ; the inner angle of the wrist is pronounced, almost dentiform ; there are no granular or pectinated crests of any kind on the palm : the fingers are little bent and leave no large gap between them when closed, there are some sharpish granules along the upper border of the dactylus, and along the lower border of the fixed finger.

The legs are remarkably uneven in length, the third pair being more than  $2\frac{1}{2}$  times the length of the carapace ; the meropodites are not exactly foliaceous, their greatest breadth being hardly two-fifths of their length, and they have a subterminal spine on the anterior border only ; the dactyli are remarkably long, those of the third pair being as long as their propodites.

In the Indian Museum are 2 females from the Andamans : the carapace of the larger one is 18 millim. long and 20 millim. in its greatest breadth posteriorly.

### 113. *Sesarma Kraussi*, de Man.

*Sesarma Kraussi*, de Man, Zool. Jahrb., Syst., II. 1887, p. 652, and Journ. Linn. Soc., Zool., XXII. 1888, p. 193, pl. xiv. figs. 1-3.

Differs from *S. longipes*, which it closely resembles, in the following characters :—

(1) the four post-frontal lobes are not so prominent, the outer ones, indeed, being very inconspicuous :

(2) the free edge of the front is more sinuous, owing to the depth of the median notch :

(3) there are two distinct teeth on the lateral border of the carapace, behind the outer orbital angle :

(4) the outer surface of the wrist and both surfaces of the palm are nearly smooth, and there is a row of sharp granules along the outer surface of the fixed finger : the upper border of the arm does not end acutely :

(5) the legs are even longer and slenderer, the 3rd pair being more than  $3\frac{1}{2}$  times the length of the carapace : the meropodites of the legs are at least 3 times as long as broad.

In the Indian Museum is a single male from the Nicobars : its carapace is 9 millim. long and 11 millim. in greatest breadth.

Heller ("Novara" Crust. pp. 64, 65) includes the following species in the Indian fauna :—

*S. Eydoussi*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. p. 184 (Madras).

*S. indica*, Milne Edwards, *tom. cit.* p. 186 (Ceylon, Nicobars).

*S. gracilipes*, Milne Edwards, *tom. cit.* p. 182 (Nicobars).

#### SARMATIUM, Dana.

*Sarmatium*, Dana, Silliman's Amer. Journ. Sci. (2) XII. 1851, p. 288, and Proc. Ac. Nat. Sci. Philad. 1851, p. 251, and U. S. Expl. Exp. Crust. pt. I. p. 357 : Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 212 : de Man, Zool. Jahrb., Syst., II, 1887, p. 659.

*Metagrapsus*, Milne Edwards, Ann. Sci. Nat., Zool., (8) XX. 1858, p. 188.

This genus, which I almost agree with Dr. de Man in regarding as only a subgenus of *Sesarma*, differs from *Sesarma* in the following particulars :—

(1) the front, instead of being abruptly and vertically deflexed, is gradually declivous and obliquely deflexed :

(2) the antero-lateral borders of the carapace are usually a little arched, instead of being in the same straight line with the postero-lateral borders :

(3) the abdomen of the male does not completely coincide with the breadth of the sternum at the level of the 5th pair of legs ; and in the female the terminal segment is not deeply impacted in the penultimate segment.

*Distribution* : West Indies, West coast of Africa, Indo-Pacific.

#### 114. *Sarmatium crassum*, Dana.

*Sarmatium crassum*, Dana, Proc. Ac. Nat. Sci. Philad. 1851, p. 251 ; U. S. Expl. Exp. Crust. pt. I. p. 358, pl. xxiii. figs. 1 a-d : Milne Edwards, Ann. Sci. Nat., Zool., (8) XX. 1858, p. 189 : Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 212 : de Man, Zool. Jahrb. Syst. II. 1887, p. 660.

Carapace deep, broader than long, broader behind than in front, smooth, with very faint indications of regions and no oblique striæ on the epibranchial regions : of the post-frontal lobes the two middle ones alone are distinct, and they are not prominent, they occupy almost all the space between the orbits.

The front is half the extent of the anterior border of the carapace, its free edge is very little concave in the middle line. The antero-lateral borders of the carapace are distinctly arched and are cut into 2 broad blunt lobes (one of which is the orbital angle) followed by a small tooth.

Chelipeds "of male short, hand above transversely four to five-plicate, externally nearly smooth, moveable finger with four short rudiments of spines, carpus mostly smooth, a few seriate granules above." In the female the transverse plications of the upper surface of the hand are very indistinct and the dactylus is smooth.

Legs not much compressed: the meropodites are not broadened, there is a spinule at the distal end of their anterior border: the dactyli are slender but are shorter than the propodites.

In the Indian Museum is a young female from the Nicobars: its carapace is 8 millim. long and 9 broad.

Henderson (Trans. Linn. Soc., Zool., (2) V. 1898, p. 398) describes a variety of *Sarmatium indicum* (Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 174, pl. xxvi. figs. 1-5) from Cochin.

#### METASESARMA, Edw.

*Metasesarma*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 168: Kingsley, Proc. Acad. Nat. Sci. Philad. 1890, p. 211: de Man, Zool. Jahrb., Syst. IX. 1895-97, p. 138.

The most marked difference between this genus and *Sesarma*, which it closely resembles, is that the tooth at the inner angle of the orbit meets the thickened angle of the front, so as to completely exclude the antennæ from the orbit.

The regions of the carapace are not defined, and the post-frontal tubercles are inconspicuous: the front is vertically deflexed as in *Sesarma*, but is deeper and overhangs the epistome: the reticulate appearance of the pterygostomian and neighbouring regions is finer, closer, and more confused: the orbits are more open below: the antennæ are much smaller: the legs are not so broad and compressed.

The *Metasesarmata* are land and fresh-water crabs of the Indo-Pacific region.

#### 115. *Metasesarma Rousseauxii*, Edw.

*Metasesarma Rousseauxii*, Milne Edwards, Ann. Sci. Nat., Zool. (3) XX. 1853, p. 168, and Archiv. du Mus. VII. 1855, p. 158, pl. x. figs. 1 a-c: Kingsley, Proc. Ac. Nat. Sci. Philad. 1890, p. 211: de Man, Zool. Jahrb., Syst., IV. 1889, p. 439, and IX. 1895-97, p. 138, and X. 1898, pl. xxix. fig. 28, and in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. p. 350: Henderson, Trans. Linn. Soc., Zool., (2) V. 1898, p. 392: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 717.

*Sesarma Aubryi*, de Man (nec A. M. Edw.), Journ. Linn. Soc., Zool., XXII. 1888, p. 168.

Carapace deepish, a little broader than long, smooth to the naked eye, slightly convex fore and aft: a short semilunar groove separates the gastric from the cardiac region, and there is a median longitudinal post-frontal groove of some depth: the middle pair of post-frontal tubercles are distinct, though not prominent, but the outer ones are hardly distinguishable.

Front a little more than half the breadth of the carapace, vertical, deep, somewhat spathulate, the free edge convex and very slightly sinuous.

Sides of the carapace slightly curved and convergent posteriorly, no tooth behind the outer orbital angle.

The chelipeds are longer and more massive in the male, but are otherwise similar in both sexes: in the male they are less than  $1\frac{1}{2}$  times the length of the carapace. To the naked eye they are smooth, except for a patch of vesiculous granules in the middle of the inner surface of the palm. The inner angle of the wrist is sharply pronounced, and the upper border of the palm and of the base of the dactylus have a few small blunt serrulations. The palm is as high as long, the dactylus is about  $1\frac{1}{2}$  times the length of the upper border of the palm, the fingers, though a little hollowed at tip, are subacute and have no gap between them when closed.

Legs rather slender, smooth and unarmed to the naked eye: the meropodites are not broadened: the dactyli are as long as their propodites and like them are fringed with dark spine-like bristles. The 3rd pair of legs, which are the longest, are less than twice the length of the carapace.

In the Indian Museum are 61 specimens from the Andamans and Nicobars, Mergui, Ganges Delta, Madras, and Minnikoy (Laccadives). Many of the specimens were taken on land, hiding under timber, in which situation their curious mottled coloration must be protective. The largest specimen has a carapace 14 millim. long by nearly 17 broad.

#### CLISTOCÆLOMA, A. M. Edw.

*Clistocœloma*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 310: Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, p. 219.

Differs from *Sesarma* only in the following characters:—

(1) the tooth at the inner angle of the lower border of the orbit meets the front, as in *Metasesarma*, so as to completely exclude the antennæ from the orbit:

(2) the reticulation of the sidewalls of the carapace resembles that of *Sesarma*, but, on denudation, the lines of granules are found to be absent, so that the meshwork is made up of hairs entirely:

(3) the merus of the external maxillipeds is shorter.

From *Metasesarma* this genus is distinguished by the lobulation of the dorsum of the carapace and the dentate lateral borders.

If *Metasesarma* is to be classed as a subgenus of *Sesarma* as it has been, and with undoubted reason, by Dr. de Man, the same course might be taken with *Clistocœloma*.



116. *Olistocaloma balansæ*, Edw.

*Olistocaloma balansæ*, A. Milne Edwards, *Nouv. Archiv. du Mus.* IX. 1873, p. 311, pl. xvii. fig. 1.

The whole body and the appendages, except the tips of the dactyli of the legs, are everywhere covered with a dark dense adherent fur, amid which, on the dorsal aspect, are numerous clumps of tomentum that look like tubercles: the legs, in addition, have a shaggy fringe of coarse hair.

Carapace square, as long as broad, somewhat depressed: when denuded it is smooth and polished, with all the regions well defined and boldly and symmetrically lobulated, and the post-frontal lobes prominent, the outer ones being again subdivided into two tubercles.

Front much more than half the breadth of the carapace, nearly vertically deflexed, deepish, its free margin sinuous and turned up to form a trenchant horizontal edge.

The lateral borders of the carapace are cut, anteriorly, into three lobes including the outer orbital angle.

Chelipeds subequal, nearly similar in size in both sexes, not more massive than the legs, shorter even than the 1st pair of legs, which are little longer than the carapace. When denuded they are smooth, except that the upper surface of the wrist is a little lumpy: the inner border of the arm is a little convex distally, but does not expand into an undoubted lobe: the palm is higher than long, but is by no means swollen or massive, and in the male only its upper surface is traversed, obliquely fore and aft, as close as possible to the upper border, by a fine microscopically-pectinate crest: the fingers are subacute, though slightly hollowed at tip, and have no wide gap between them when closed, and the fixed finger is shorter and deeper than the dactylus, the dactylus is nearly twice as long as the upper border of the palm, and in the male its upper border is milled with about 14 or 15 lamellæ.

Legs markedly unequal: the third pair, which are the longest, are not quite twice as long as the carapace. In all, the meropodites are thin and broad, and the dactyli are not two-thirds as long as their propodites.

In the Indian Museum are a male and two females from the Nicobars. The carapace of the largest is 19 millim. in either diameter.

117. *Olistocaloma merguense*, de Man.

*Olistocaloma merguensis*, de Man, *Journ. Linn. Soc., Zool.*, XXII. 1888, p. 195, pl. xiii, fig. 10, and *Notes Leyden Mus.* XII. 1890, p. 92: and *Zool. Jahrb., Syst.*, IX. 1895-97, p. 339, and X. 1898, pl. xxxi. fig. 40.

This species differs from *O. balanæ* in the following particulars:—

(1) the carapace is decidedly broader than long, its lobulations are not nearly so bold and convex, and the outer post-frontal lobules may be entire:

(2) the free edge of the front is not turned up to form a trenchant horizontal crest, although it is well defined:

(3) the chelipeds of the male are far more massive than any of the legs; the inner border of the arm is dilated distally; the palm is a good deal swollen, the pectinate crest that traverses its upper surface is longer, and its inner surface is more granular; the fingers are more widely separated when closed, and the lamellar tubercles along the upper border of the dactylus are more numerous:

(4) it is a smaller species.

In the Indian Museum are 10 specimens from the Nicobars: the carapace of the largest egg-laden female is 10 millim. long and 12 broad.

#### METAPLAX, Edw.

*Metaplas*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XVIII. 1852, p. 161.

*Rhaconotus*, Gerstaecker, Archiv f. Naturges. XXII. 1856, i. p. 140, and Kingsley, Proc. Ac. Nat. Sci. Philad., 1880, p. 213.

*Metaplas*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, pp. 153-155.

Carapace quadrilateral, somewhat depressed, a good deal broader than long, the regions well or fairly defined and the cervical and branchial grooves distinct.

Front declivous, its breadth about a third or a fourth that of the carapace, the convexity of its free edge impinges on the epistome to help in forming the broad interantennular septum.

Lateral borders of the carapace straight, or a little arched anteriorly, nearly parallel, cut into 4 or 5 teeth of which the last one or two are very inconspicuous. The posterior part of the sidewalls of the carapace with some hairs curving towards the incurrent branchial opening.

Orbits of good depth: their outer wall incomplete, their lower border crenulate: the eyes do not fill the orbits and the eyestalks are not prolonged.

The antennules fold nearly transversely: the septum between them is broad. The antennæ lie in the orbital hiatus, their basal joint is extremely short, their flagellum is of fair length.

Epistome short, but well defined and prominent: buccal cavern squarish: the external maxillipeds leave between them a large rhomb-

oidal gap, in which the mandibles are exposed : a broad oblique groove, bounded internally by a line of hairs, runs from a point behind the antero-external angle of the ischium to the anterior edge of the merus : the merus is truncated, and the foliaceous propodite articulates near its antero-external angle.

The chelipeds differ very markedly in the sexes : in the female they are shorter and slenderer than the legs, but in the male they are longer and much more massive than the legs. In the male there is always a short oblique horny crest, either on or close to and parallel with, the inner border of the arm, as in many species of *Macrophthalmus* : it probably, as Dr. de Man suggests, is scraped against the lower border of the orbit to produce a musical sound.

Legs slender, the first and last pairs much shorter than the 2nd and 3rd pairs—the 3rd pair the longest.

The abdomen in the male does not quite cover the sternum between the bases of the last pair of legs : it may have all 7 segments distinct, or, rarely, the 3rd 4th and 5th segments may be fused together : in the female all 7 segments are separate and the 7th is small and deeply impacted in the 6th, as in *Sesarma*.

*Distribution* : Estuaries and mudflats of the Oriental littoral.

The species of *Metaplax* have many points of resemblance with the Ocypodoid genus *Macrophthalmus*, and this is all the more likely to lead to confusion as the two genera share the same habitat and have the same manner of life ; but there is no doubt of the true position of *Metaplax* among the *Sesarminæ*.

#### *Key to the Indian species of Metaplax.*

- I. Anterior border of carpi and propodites of legs spiny : chelipeds in the male 3 times the length of the carapace..... *M. crenulata*.
- II. Anterior border of carpopodites and propodites of legs smooth : male chelipeds less than 3 times the length of the carapace :—
  - i. Dactylus of chelæ of male without any prominent lobe on its dentary edge : chelipeds of male equal :—
    - i. 3rd 4th and 5th abdominal segments fused together in the male..... *M. indica*.
    - ii. All the abdominal segments separate :—
      - a. Length of the carapace about three-fourths the breadth : orbital portion of lower border of orbit with 4 or 5 teeth... *M. dentipes*.
      - b. Length of the carapace less than three-fourths the breadth : orbital portion of lower border of orbit with 9 or 10 teeth... *M. distincta*.

2. Dactylus of chelæ of male with a prominent lobe projecting on the dentary edge: chelipeds of male markedly unequal:—

- i. Palm of larger cheliped of male longer than high. *M. elegans.*
- ii. Palm of larger cheliped of male higher than long. *M. intermedia.*

118. *Metaplas indica*, Edw.

*Metaplas indicus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 161, and Archiv. du Mus. VII. 1855, p. 165, pl. xi. figs. 2-2c.

Carapace about two-thirds as long as broad, deepish, a little convex, its surface smooth, the regions and the cervical and epibranchial grooves faint.

Front about a third the greatest breadth of the carapace. Lateral borders of the carapace nearly straight, cut into 4 teeth, of which the first 2 are large, the 3rd very small, and the 4th very inconspicuous.

Lower border of the orbit of the male continued to the level of the first notch in the lateral border of the carapace, unevenly crenulate.

Chelipeds of the male equal, more than  $2\frac{1}{2}$  times the length of the carapace, smooth and unarmed, to the naked eye: arm long and slender, projecting far beyond the carapace, its muscular crest is almost on the inner border, close to its proximal end: palm nearly twice as long as high, increasing in height from its proximal to its distal end: fingers slender, acute, not noticeably channelled and only moderately incurved, neither of them have any large lobes on their dentary edge, the dactylus is hardly shorter than the upper border of the palm, and though it is deflexed is not hooked.

Legs quite unarmed, the carpopodites and propodites of the two middle pairs remarkably tomentose: the third pair of legs are a little more than twice as long as the carapace.

The 3rd 4th and 5th abdominal segments of the male are fused together—though the sutures are not obliterated on either side, but only in the middle—to form a single piece.

In the female the chelipeds are very slender, quite smooth, a little longer than the carapace, and the lower border of the orbit is finely and evenly serrulate.

In the Indian Museum are a male and a female from Karachi: the carapace of the male is 10 millim. long and 14.5 millim. broad.

119. *Metaplas distincta*, Edw.

*Metaplas distinctus*, Milne Edwards, Ann. Sci. Nat., Zool., (3) XVIII. 1852, p. 162, pl. iv. fig. 27: de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 158, pl. x. figs. 7-9: Henderson, Trans. Linn. Soc., Zool., (2) V. 1898, p. 391.

Differs from *M. indica* in the following characters:—

(1) the carapace is more than two-thirds—nearly three-quarters—as long as broad:

(2) the lower border of the orbit of the male is prolonged to the level of the second notch in the lateral border of the carapace, and its orbital portion is cut into 9 or 10 little, blunt, obscurely-bilobulate teeth, which decrease very regularly in size from within outwards:

(3) the chelipeds of the male are hardly  $2\frac{1}{2}$  times the length of the carapace; the arm has denticulate borders—the inner border being a little dilated distally—and is not elongate and slender, its musical crest runs obliquely away from the inner border and is nearer to the middle of that border: the palm is only about half again as long as high: the fingers are obliquely-truncated and channelled at tip, the fixed finger has a lobe (though not a very large one) on its dentary edge, the dactylus is hardly shorter than the upper border of the palm and has a strong hook-like curve:

(4) the anterior border of the meropodites of the legs is armed, in the first and last pairs with a single subterminal spine, in the middle two pairs with several spines; the tomentum on the carpopodites and propodites of the middle two pairs of legs is not so thick:

(5) the abdomen of the male consists of 7 separate segments.

In the Indian Museum are 8 specimens from Madras, Coconada, Mergui, and the Nicobars: the carapace of the largest male is 15 millim. long and 21 broad.

#### 120. *Metaplas dentipes* (Heller).

*Helice dentipes*, Heller, Novara Crust. p. 62, pl. v. fig. 5: Kingsley, Proc. Ac. Nat. Sci. Philad. 1890, p. 220.

*Metaplas dentipes*, de Man, Journ. Linn. Soc., Zool., XXII, 1888, p. 162, pl. xi. figs. 1-3.

This is little more than a large variety of *M. distincta*, from which it differs in the following particulars:—

(1) the carapace is less transverse, its length being slightly more than three-fourths of its breadth:

(2) the lower border of the orbit of the male is divided, in its orbital portion, into 4 or 5 blunt, broad, compressed teeth decreasing in size from within outwards, and each tooth has a little cusp at its outer end:

(3) in the chelipeds, the inner border of the arm is more dilated distally; the lobe on the dentary edge of the fixed finger is not so convex, and the dactylus is as long as the upper border of the palm

and is not so strongly hooked; the dactylus also sometimes has an enlarged tooth—not a distinct lobe—near the middle of its dentary border:

(4) the anterior border of the meropodites of the legs is very often quite free from spines, but sometimes there are inconspicuous spinules where spines exist in *M. distincta*.

In the Indian Museum are 23 specimens from the banks of the Hooghly, the mud-flats of Arakan and Tenasserim, and Mergui. The carapace of a large male is a little over 21 millim. long and 29 millim. broad.

#### 121. *Metaplas elegans*, de Man.

*Metaplas elegans*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 164, pl. xi. figs. 4-6, and Zool. Jahrb., Syst., VIII. 1894-95, p. 596.

*Metaplas crassipes*, de Man, in Weber's Zool. Ergebn. Niederl. Ost-Ind. II. 1892, p. 325, pl. xix. fig. 12 (*ipso teste*).

Resembles *M. indica* in the form of the carapace, but can be recognized by the following characters:—

(1) the grooves of the carapace are fainter:

(2) the lower border of the orbit instead of being irregularly cut into dentiform lobules is very finely and regularly pectinate:

(3) the chelipeds in the male are not  $2\frac{1}{2}$  times as long as the carapace and are distinctly unequal, the hand of one being decidedly larger than its fellow: the arm is not elongate, its edges are granular, and its muscular crest, which is very fine, stands at the middle of the inner border, running obliquely parallel with that border: the larger palm is only a little longer than high and its inner surface is granular, its fingers are obliquely truncate and strongly channelled, and both of them have a lobe near the middle of their dentary border, the dactylus also is strongly curved, at any rate in the larger hand:

(4) in the first pair of legs the meropodites have a single subterminal spine on the anterior border, in the 2nd pair there are from three to six spines, and in the 3rd and 4th pairs from seven to ten: moreover at the extreme distal end of the *posterior* border of the meropodites of the two middle pairs of legs there may be two or three spinules:

(5) the abdomen of the male is broader, and has all 7 segments separate.

In the Indian Museum are 32 specimens from the Godavari Delta and from Mergui: the carapace of the largest male is 10.5 millim. long and 16 broad.

122. *Metaplas intermedia*, de Man.

*Metaplas intermedius*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 166, pl. xi. figs. 7-9.

Differs from *M. indica* in the following characters:—

(1) In the male the lower border of the orbit is continued a little beyond the first notch in the antero-lateral border of the carapace, and at its inner end it is cut into a series of 5 or 6 little even teeth that decrease in size from within outwards, and then it gradually becomes minutely and regularly pectinate:

(2) the chelipeds of the male are markedly unequal, the difference in size being in the hand: their length is about  $2\frac{1}{2}$  times that of the carapace: the arm is of no great length and is somewhat broadened across the middle, its edges are granular, and its musical crest lies in the middle of the inner border, close to and nearly parallel with that border: the palm has granular edges and is much compressed at its antero-inferior corner; in the larger cheliped *the hand is at least as high as long*: the fingers are obliquely truncated and strongly channelled; in the larger hand the dactylus is hooked and has a lobe on its cutting edge near the proximal end, while the fixed finger is broad, is thin and compressed at its basal end, and presents on its cutting edge a notch (corresponding with the lobe on the dactylus) followed by a high lobe that descends obliquely to the tip of the finger:

(3) near the far end of the anterior border of the meropodites of the legs is a spine:

(4) the abdomen of the male has all 7 segments distinct, and is rather broadly triangular.

In the Indian Museum are 11 specimens from the Godavari Delta, the Gangetic Delta and Mergui. The carapace of the largest male is  $9\frac{1}{2}$  millim. long and 15 broad.

123. *Metaplas crenulata*, Gerstaecker.

*Rhaconotus crenulatus*, Gerstaecker, Arch. f. Naturges. XXII. i. 1856, p. 142, pl. v. fig. 5: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 213.

*Metaplas crenulatus*, de Man, Journ. Linn. Soc., Zool., XXII. 1888, p. 156, and Zool. Jahrb., Syst., IV. 1889, p. 439.

Carapace about three-fourths as long as broad, convex, with the regions well defined and the cervical and epibranchial furrows deep and coarse, its surface pitted.

Front about a fourth the greatest breadth of the carapace. Lateral borders of the carapace out into five teeth, the edges of which are serrated; the anterior part of the lateral borders is distinctly arched.

The lower border of the orbit, in the male, extends beyond the first notch of the lateral border of the carapace, its inner end is sharp entire and sinuous, but all the rest of its extent is elegantly beaded.

Chelipeds of the male three times the length of the carapace, the borders of the wrist and hand, and the inner border of the wrist, sharply granular or serrulate: arm long and slender, somewhat dilated at its proximal end, the muscular crest close to the proximal end and almost on the inner border: the palm gradually increases in height from behind forwards, its greatest height is about half its length, along the middle of its inner surface is a row of granules ending in a granular patch: fingers slender, acute, incurved, not channelled, the extreme length of the dactylus is only about three-fourths that of the upper border of the palm: there are no prominent lobes on the dentary edges of the fingers.

Both borders of the meropodites of the legs, as well as the anterior border of the carpopodites and propodites, are spinulate. The third pair of legs are nearly as long as the male chelipeds.

In the abdomen of the male, which is narrow, all 7 segments are distinct, the penultimate segment being square.

In the female the chelipeds are very slender and are about  $1\frac{1}{2}$  times the length of the carapace, and the lower border of the orbit is elegantly pectinate.

In the Indian Museum are 11 specimens from the Sunderbunds and Mergui. The carapace of the largest male is 30 millim. long and 40 broad.

#### Sub-family PLAGUSIINÆ, Dana.

##### PLAGUSIA, Latreille.

*Plagusia* (part), Latreille, Gen. Crust. et Ins. p. 33 (1806): Desmarest, Consid. Gen. Crust. p. 126 (part): De Haan, Faun. Japon. Crust. p. 31: Milne Edwards (part), Hist. Nat. Crust. II. 90, and Ann. Sci. Nat. Zool., (3) XX. 1853, p. 178: Miers, Ann. Mag. Nat. Hist. (5) I. 1878, p. 148, and Challenger Brachyura, p. 271: Kingsley, Proc. Ac. Nat. Sci. Philad., 1880, pp. 189, 223.

*Philyra*, De Haan, *l.c. supra*.

Carapace subcircular, depressed, the antero-lateral borders toothed. The interorbital space is broad, being nearly a third the greatest breadth of the carapace; but there is no true front, so that the antennular fossæ, into which the antennules fold nearly vertically, are visible in a dorsal view as deep clefts in the anterior border of the carapace. The interantennular septum is broad. Orbits deep: the antennæ stand in the wide orbital hiatus, their flagellum is short.



Epistome short: buccal cavern squarish, its anterior border is crenate and projects strongly in a horizontal direction. The external maxillipeds do not meet across the buccal cavern, but the space between them, which is not very broad, is occluded by bristles: their merus is as broad as the ischium and carries the palp at its summit: *their exognath has no flagellum.*

Chelipeds and legs dorsally rugose. Chelipeds subequal: in the male they are more massive than the legs, and longer than those of the first and last pairs, in the female they are shorter and slenderer than any of the legs: the fingers are stout and have rounded hollowed-out tips.

Legs very stout, with broad massive meri and short stout serrated dactyli.

The abdomen of the male is triangular and rather broad: it covers all the sternum between the last pair of legs, and it may have all 7 segments distinct or the 3rd 4th and 5th fused. In the female the abdomen is broad and consists of 7 segments, but the 3rd 4th and 5th do not move independently of one another.

*Distribution:* all warm seas, and extending into the Mediterranean.

In habit the *Plagusia* to a certain extent resemble the *Grapsi*, dodging about rocks that are awash at high tide, and hiding in crannies when pursued. They also resemble *Varuna* in being able to make themselves at home on drift timber in the open sea. This will account for the very wide range of some of the species.

The presence of two species in the Mediterranean implies nothing, of itself, for they may very probably have been carried there by ships. On the "Investigator" one could always see a *Plagusia* adhering to the ship's side near the water-line.

#### 124. *Plagusia depressa* var. *squamosa* (Hbst.).

? *Cancer depressus*, Herbst (nec Fabr.), Krabben &c. I. ii. 117, pl. iii. figs. 35 a-d. *Cancer squamosus*, Herbst, I. ii. 260, pl. xx. fig. 113 (v. Hilgendorf, SB. Ges. Nat. Freunde, 1882, p. 24).

*Plagusia squamosa*, Latreille, Gen. Crust. p. 34, and Nouv. Diot. Hist. Nat. XXVI. p. 533, and (?) Encycl. Méthod. X. 1825, p. 145: Lamarck, Hist. Nat. Anim. Sans Verh. p. 246: Milne Edwards, Hist. Nat. Crust. II. 94: Krauss, Sudaf. Crust. p. 42: Milne Edwards, Ann. Sci. Nat., Zool., (8) XX. 1853, p. 178: Heller, SB. Akad. Wien, XLIII. 1861, p. 363, and Novara Crust. p. 51: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 298: Richters, in Möbins, Meeresf. Maurit. p. 157: Hilgendorf, SB. Ges. Nat. Freunde, Berlin, 1882, p. 24.

*Plagusia tuberculata*, Lamarck, l. c. p. 247: Latreille, Encycl. Méthod. X. p. 146: Milne Edwards, l. c. p. 94: Miers, Ann. Mag. Nat. Hist. (5) I. 1878, p. 148: Haswell, Cat. Austral. Crust. p. 110: Müller, Verh. Ges. Basal, VIII. 1886, p. 476: de Man, Notes Leyden Mus. V. 1888, p. 168, and Zool. Jahrb., Syst., IX. 1895-97,

p. 358 : Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 730 : M. J. Rathbun, P. U. S. Nat. Mus. XXI. 1898, p. 605.

*Plagusia immaculata*, Lamarck, l. c. p. 247 : Miers, l. c., p. 150, and Challenger Brachyura, p. 273, pl. xxii. fig. 1 : Haswell, l. c. : de Man, Archiv für Naturges. LIII. 1887, i. p. 371 : Cano, Boll. Soc. Nat. Napol. III. 1889, p. 246 : Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 391 : Ortmann, l. c. : Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 271.

*Plagusia depressa*, Latreille (*nec* Fabr.), Encycl. Méth. X. 145 : Milne Edwards, Hist. Nat. Crust. II. 93, and Ann. Sci. Nat., Zool., (3) XX. 1853, p. 179 : Heller, Novara Crust. p. 51.

*Plagusia orientalis*, Stimpson, Proc. Ao. Nat. Sci. Philad. 1858, p. 103, and Ann. Lyo. Nat. Hist. New York, VII. 1860, p. 231.

All the regions of the carapace are distinct, and the surface is covered with flat pearly or squamiform tubercles which are fringed anteriorly with little close-set bristles of uniform length.

The tubercles vary: sometimes they are prominent, sometimes depressed, and sometimes they are almost obsolete on the most convex portions of the carapace. The little fringes of bristles also vary: sometimes they fill all the space between the tubercles, sometimes they can only be made out with a lens, sometimes they are absent.

The antero-lateral border of the carapace is armed with four teeth (including the orbital angle) which decrease in size from before backwards. The epistome is prominent beyond the anterior border of the carapace and is usually cut into seven lobes.

The chelipeds of the adult male are massive and are about half again as long as the carapace, but in the female they are slender and only about as long as the carapace. The inner angle of the wrist is coarsely dentiform: the tubercles on the upper surface of the palm and dactylus are arranged in high relief in longitudinal rows, those on the outer surface of the palm—especially at the upper part of it—have a tendency to fall into transverse rows.

On the posterior edge of the dorsal surface of the basipodites of the legs is a subacute tooth or blunt lobe with entire edges, this tooth being most conspicuous in the 2nd and 3rd pair of legs: on the anterior border of the meropodites there is a single strong spine, subterminal in position: the upper surface of the carpopodites propodites and dactyli is traversed longitudinally by a dense strip of long bristles. The 3rd pair of legs, which are the longest, are not quite twice the length of the carapace.

In the Indian Museum are 31 specimens from the Bay of Bengal and Arabian Sea: many of them were taken from drift timber in the open sea. Old specimens are commonly encrusted with barnacles and acorn-shells. The largest specimen in the collection has a carapace 54 millim. long and 56 broad.

## LIOLOPHUS, Miers.

*Leiolophus*, Miers, Cat. Crust. New Zealand, p. 46 (1876), and Ann. Mag. Nat. Hist. (5) I. 1878, p. 153.

*Acanthopus*, De Haan, Faun. Japon. Crust. p. 29: Dana, U.S. Expl. Exp. Crust. pt. I. p. 372: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. 1853, p. 180 (*nom. præocc.*).

As in *Plagusia*, the antennæ fold nearly vertically in deep slits—visible in a dorsal view—out in the anterior border of the carapace, the slits dividing the interorbital space into three deep lobes; and the exognath of the external maxillipeds has no flagellum.

The difference from *Plagusia* is as follows:—

The carapace is extremely flat and depressed—being quite disk-like—and is longer than broad: the interantennular septum is of no great breadth: the epistome is almost linear: the merus of the external maxillipeds is very small, being much narrower than the ischium, and is disposed obliquely in repose: the chelipeds and legs, though in places spiny, are not rugose: the legs are much slenderer, and though the meropodites are broad they are very thin: the copulatory organ of the male ends in a claw: finally, the exognath of the external maxillipeds is extremely short and slender.

As in the Indian species of *Plagusia*, the abdomen of the male consists of 5 segments, the 3rd 4th and 5th being fused. The abdomen of the female is similar in this respect to that of the male.

*Distribution*: as *Plagusia*, but not in the Mediterranean.

125. *Liolophus planissimus* (Hbst.).

*Cancer planipes*, Seba, Thesaurus III. p. 49, pl. xix. fig. 21 (1758).

*Cancer planissimus*, Herbst, Krabben &c. III. iv. 3, pl. lix. fig. 3 (1804).

*Plagusia clavimana*, Latreille, Gen. Crust. p. 34: Lamarck, Hist. Nat. Anim. Sans Vert., Crust., p. 247: Desmarest, Dict. Sci. Nat. XXVIII. p. 246: Latreille, Encycl. Méthod. X. p. 146: Desmarest, Consid. Gen. Crust. p. 127, pl. xiv. fig. 2: Milne Edwards, Hist. Nat. Crust. II. 92, and in Cuvier, Règne Animal, Crust. pl. xxiii. fig. 3: Hess, Archiv f. Nat. XXXI. 1865, i. p. 154: Desbonne et Schramm, Crust. Guadaloupe, p. 50: Richters in Möbins' Meeresf. Maurit. p. 167.

*Plagusia serripes*, Lamarck, loc. cit.: Latreille, Encycl. Méthod. loc. cit.

*Acanthopus planissimus*, De Haan, Faun. Japon. Crust. p. 30: Dana, U. S. Expl. Exp. Crust. pt. I. p. 372: Milne Edwards, Ann. Sci. Nat., Zool., (3) XX. p. 180: Heller, SB. Ak. Wien, XLIII. 1861, p. 364: Stimpson, Ann. Lyc. Nat. Hist. New York, VII. 1862, p. 232: Heller, Novara Crust. p. 51: A. Milne Edwards, Nouv. Archiv. du Mus. IX. 1873, p. 299: Broochi, Ann. Sci. Nat., Zool., (6) II. 1875, Art. 2 (*male appendages*): Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 31 (*gastric teeth*).

*Acanthopus clavimanus*, Krauss, Sudaf. Crust., p. 42.

*Acanthopus gibbesi*, Milne Edwards, Ann. Sci. Nat. Zool. loc. cit.

*Leiolophus planissimus*, Miers, Cat. Crust. N. Z. p. 46, and Ann. Mag. Nat. Hist. (5) I. 1878, p. 153, and P. Z. S. 1879, p. 38, and Zool. H. M. S. Alort, pp. 518, 545:

Filhol, *Crust. N. Z.*, Miss. l'île Campbell, p. 394: Haswell, *Cat. Austral. Crust.* p. 112: Müller, *Verh. Ges. Nat. Basel*, 1836, p. 476: de Man, *Arch. f. Nat.* LIII. 1837, i. p. 372, and *Notes Leyden Mus.* XV. 1893, p. 287, and *Zool. Jahrb., Syst.*, IX. 1895-97, p. 358: Pocock, *Journ. Linn. Soc., Zool.*, XX. 1890, p. 513: Henderson, *Trans. Linn. Soc. Zool.* (2) V. 1893, p. 391: Ortmann, *Zool. Jahrb., Syst.*, VII. 1893-94, p. 731: Whitelegge, *Mem. Austral. Mus.* III. 1897, p. 139: M. J. Rathbun, *Ann. Inst. Jamaica*, I. 1897, p. 36.

Carapace thin, disk-like, covered with little short bristles which, however, leave certain symmetrical raised linear patches bare: the meropodites of the legs are clad in the same way, and have two long bare stripes.

The front, the antennular and supra-orbital angles, and the epistome are all acutely spinous: the antero-lateral border of the carapace is armed with 4 acute spines: the middle of the upper border of the orbit is more or less serrate. The eyes are large and reniform.

The chelipeds vary according to age and sex, but the arm and wrist are always armed with spines; the palm is smooth, nude, oval, and somewhat compressed; and the fingers are short, blunt, and hollowed at tip. In the adult male the palms, or one of them, are remarkably deep.

The anterior border of the meropodites of all the legs is armed along its whole length with remarkably large and even spines, the posterior border ends in a spine: in the case of the first two meropodites there is a second row of spinules parallel with the anterior border, but this is very indistinct in the meropodites of the 3rd pair, and quite absent in those of the 4th.

The colour in life is dark green, the nude streaks being bright green. In the Indian Museum are 36 specimens from the Andamans, Ceylon, and Laccadives: the carapace of the largest is 23 millim. long and 21 broad.

### Family GEOCARCINIDÆ, Dana.

#### *Key to the Indian Genera.*

- I. Fronto-orbital border more than half the maximum breadth of the carapace: interantennular septum broad: epistome well defined and prominent: dactyli of legs with 4 rows of spines:—
  1. Buccal cavern not elongate: exognath of external maxillipeds without a flagellum: opposed edges of the basal joints of the 2nd and 3rd pairs of legs heavily fringed with hair much as in *Ocypoda*:—
    - i. Antero-lateral borders of carapace dentate..... **GRAPSODES.**
    - ii. Antero-lateral borders of carapace entire..... **EPIGRAPSUS.**

2. Buccal cavern elongate : exognath of external maxillipeds with a flagellum : no hairy fringe on the basal joints of the 2nd and 3rd pairs of legs..... **CARDIOSOMA.**
- II. Fronto-orbital border less than half the greatest breadth of the carapace : interantennular septum narrow : epistome ill-defined and sunken : dactyli of legs with 6 rows of spines : exognath of external maxillipeds without a flagellum..... **PELOCARCINUS.**

### GRAPSOIDES, Heller.

*Grapsodes*, Heller, *Novara Crust.* p. 58 : Kingsley, *Proc. Ac. Nat. Sci. Philad.* 1880, pp. 188, 197.

Carapace depressed, little broader than long, declivous anteriorly, the regions faintly indicated, the dorsal surface without ridges or wrinkles, the lateral borders well arched and irregularly dentate.

Front about half the width of the anterior border, or about a third the greatest breadth of the carapace, strongly deflexed, its free edge nearly straight.

Orbits small, shallow, the lower border is wanting except for the tooth at the inner angle. The antennules fold nearly transversely in fossæ which are widely open externally : interantennular septum very broad. Antennal flagella slender and very short, standing in the orbital hiatus.

Epistome of moderate length fore and aft. External maxillipeds having a rhomboidal gap between them, in which the mandibles are visible : the merus is narrower than, but about the same length as, the ischium, and is a little oblique : the palp, which though coarse is small, articulates at the antero-external angle of the merus.

Chelipeds in both sexes subequal : in the male they are very much more massive than the legs and longer than the first and last pairs : in the female they are relatively shorter and much less massive than in the male. The tips of the fingers are acute.

Legs stout, their joints are not particularly broad or compressed but have their edges armed with stout bristles : the dactyli are long, acute, and thorny. The 2nd and 3rd pair of legs are the longest, and between their bases is a recess fringed with hairs resembling that found in *Ocypoda* and *Gelasimus*, and probably indicating terrestrial or amphibious habits.

The abdomen in both sexes consists of seven segments, and in the male its base covers all the breadth of the sternum between the last pair of legs.

*Distribution* : Islands of East Indian Archipelago.

This genus is really identical with *Epigrapsus* (= *Nectograpsus*), from which it only differs in having the regions of the carapace even more indistinct, the lateral borders of the carapace entire, the male chelipeds remarkably unequal, and the dactylus of the legs alone hirsute.

126. *Grapsodes notatus*, Heller.

*Grapsodes notatus*, Heller, Novara Crust. p. 58, pl. v. fig. 2: Miers, P. Z. S. 1877, p. 136: J. S. Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 197: de Man, Notes Leyden Mus. V. 1883, p. 160.

Carapace five-sixths as long as broad, the regions defined, though faintly, the surface smooth except sometimes for some granules near the lateral borders. The antero-lateral borders are cut into three shallow teeth or lobes behind which are some inconspicuous crenulations. On the line of flexion of the front are two eminences separated by a notch. Epistome and pterygostomial regions tomentose.

The chelipeds differ considerably in the sexes, though always smooth. In the adult male they are nearly twice the length of the carapace, the inner angle of the wrist is pronounced but not spiniform, the palm (which is as high as long) has a strong bulge at the infero-posterior angle, the dactylus (which is twice as long as the upper border of the palm) is much longer than the immobile finger and closes very obliquely, and there are two molariform teeth, one near the base of the dactylus, the other nearer the tip of the immobile finger.

In the female the chelipeds are hardly  $1\frac{1}{2}$  times the length of the carapace, the inner angle of the wrist is dentiform or spiniform, the palm is not enlarged or inflated, and the fingers are of nearly equal length, meet in the greater part of their extent, and are finely denticulated except near the tips.

The second pair of legs, which are the longest, are about twice the length of the carapace, the third pair are a little shorter than the second, and the first and last pair are about  $1\frac{1}{2}$  times the length of the carapace.

In the Indian Museum are 8 specimens from the Nicobars. The carapace of the largest male is 25 millim. long and 30 millim. broad, but a female is somewhat larger than this.

That this species is probably terrestrial is evidenced by the vaulted branchial cavities, and also by the folding of the membrane that lines them, which is practically the same as that of *Ocyroda*, *Cardiosoma*, and *Pelocarcinus*.

## EPIGRAPSUS, Heller.

*Epiograpsus*, Heller, Verh. zool.-bot. Ges. Wien, XII. 1862, p. 522: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, pp. 188, 192: Miers "Challenger" Brachyura, p. 265.

*Nectograpsus*, Heller, Novara Crust. p. 56.

This genus is really identical with *Grapsodes*, from which it differs in no single point of importance.

The trivial characters that separate it from *Grapsodes* are the following:—

The regions of the carapace are hardly distinguishable, and the lateral margins are entire: the chelipeds in the male are markedly unequal, one of them being longer and vastly more massive than the legs, the other being hardly larger than those of the female (which resemble those of *Grapsodes*): though the legs resemble those of *Grapsodes* in proportions and in the singular length of the dactyli, they differ in having only the terminal joint hirsute.

*Distribution*: Islands of the East Indian Archipelago and Polynesia.

127. *Epiograpsus politus*, Heller.

*Epiograpsus politus*, Heller, Verh. zool.-bot. Ges. Wien, XII. 1862, p. 522: Kingsley, Proc. Ac. Nat. Sci. Philad. 1880, p. 192: Miers, Challenger Brachyura, p. 266: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 703: de Man, Zool. Jahrb. Syst. IX. 1895-97, p. 79.

*Nectograpsus politus*, Heller, Novara Crust. p. 57, pl. v. fig. 3.

Carapace about seven-eighths as long as broad, perfectly smooth, the outer orbital angle not pronounced and the lateral margins entire in the adult. The line of flexion of the front is a little concave in the middle. Epistome and pterygostomian regions tomentose.

Chelipeds smooth, equal in the female, markedly unequal in the male. In the male the larger cheliped is more than twice the length of the carapace, the inner angle of the wrist is not pronounced, the palm is about as high as long and has a strong bulge at its postero-inferior angle, the dactylus is much longer than the immobile finger, and the dactylus has 2 or 3 small molariform teeth while the immobile finger has a single one.

In the female the chelipeds are little longer than the carapace, have the inner angle of the wrist pronounced, the palm not enlarged or inflated, and the fingers finely and inconspicuously toothed and nearly equal in length.

The smaller cheliped of the male is but little larger than those of the female.

Of the legs the 2nd pair are the longest, being twice the length of the carapace, and the 3rd pair are slightly shorter: the 1st pair are nearly  $1\frac{1}{2}$  times, the 4th pair about  $1\frac{1}{2}$  times the length of the carapace.

In the Indian Museum are 4 specimens, from the Andamans and Nicobars: the carapace of the largest male is 14 millim. long and 16 millim. broad.

#### CARDIOSOMA, Latreille.

*Cardisoma*, Latreille, Encycl. Méthod. X. p. 685 (1825): De Haan, Faun. Japon. Crust. p. 27: Milne Edwards, Hist. Nat. Crust. II. 22, and Ann. Sci. Nat. Zool. (3) XX. 1853, p. 203: Smith, Trans. Connect. Acad. Sci. II. 1870, p. 142: Miers, Challenger Brachyura, p. 219: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 733.

? *Discoplax*, A. Milne Edwards, Ann. Soc. Entom. France, (4) VII. 1867, p. 248, and Nouv. Archiv. du Mus. IX. 1873, p. 293.

Carapace deep, convex fore and aft, transversely oval, with the lateral borders tumid and strongly arched owing to the vault-like expansion of the gill-chambers, the pterygostomian regions densely tomentose.

The fronto-orbital border is much more than half, and the deflexed and nearly straight front is about a fourth, the greatest breadth of the carapace. Orbits deep, with the outer angle defined by a denticle, and with the tooth at the inner angle well developed but distant from the front: the eyes are very loose in the orbits.

The antennules fold obliquely beneath the front, by which they are a good deal concealed: the inter-antennular septum is very broad. The antennæ lie in the orbital hiatus, which their broad basal joint nearly fills: their flagellum is very short.

Epistome short, prominent and well defined: buccal cavern elongate squarish, the external maxillipeds do not close it but leave between them a rhomboidal gap in which the mandibles are exposed. In the external maxillipeds the merus is a longish joint and carries the palp, which is large and not at all concealed, at its antero-external angle: the exognath, which carries a flagellum, is exposed in much the greater part of its extent. The exognaths of the other maxillipeds are heavily fringed with coarse hair.

The chelipeds, which are much more massive than the legs, may either be equal or markedly unequal, differing little in the sexes: they alter considerably with age—one or both—the arm and fingers becoming elongated, and the whole hand increasing in size until it becomes longer than the carapace is broad and more than half as high as the carapace is long.

The legs are stout: some of their joints are fringed with bristles, and



their long strong dactyli are square in section and have a series of spines along all four edges.

The abdomen in both sexes consists of 7 separate segments, and in the male its base covers the whole width of the sternum between the last pair of legs.

The branchiæ are eight in number on either side: the gill chambers are vaulted and remarkably capacious, and they are lined by a thick vascular membrane folded to form a sort of pocket, and as in several other crabs—such as *Gelasimus* and *Ocypoda*—that spend most of their time out of water, a sort of “choroid process” of this membrane, shaped like a gill-plume, projects laterally over the pleura of the penultimate pair of legs.

The species of this genus live on land. They are very common in the jungles of the Andamans where they may be found in the day time crouching under roots, fallen logs, &c., sometimes in burrows near the shore.

*Distribution:* West Indies and neighbouring coasts of America, Cape Verde Is. and West Coast of Africa, Indo-Pacific from Madagascar to Chili.

*Key to the Indian species of Cardiosoma.*

- I. Carapace very strongly convex fore and aft, the regions indistinct: breadth of the orbit not much more than half its length: merus of the legs with bristles only at its distal end..... *C. carnifex.*
- II. Carapace very moderately convex fore and aft, the regions distinct: breadth of the orbit about two-thirds its length: merus of the legs with bristles along its whole length..... *C. hirtipes.*

128. *Cardiosoma carnifex*, (Hbst.).

*Cancer carnifex* and *hydromus*, Herbst, Krabben etc. II. v. 163, 164, pl. xli. figs. 1, 2 (1794).

*Cardiosoma carnifex*, Latreille, Encycl. Méthod. X. p. 685: Milne Edwards, Hist. Nat. Crust. II. 23: Guégin, Icon. Règne An., Crust. pl. v. fig. 2: Dana, U. S. Expl. Exp. Crust. pt. I. p. 377: Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 204: Heller, Novara Crust. p. 85: A. Milne Edwards, Nouv. Archiv. du Mus. IV. 1868, p. 71, and IX. 1873, p. 264: Hoffmann, in Pollen and van Dam, Faun. Madagasc., Crust. p. 12: Broochi, Ann. Sci. Nat., Zool., (6) II. 1875, Art. 2, p. 85, pl. xvii. figs. 117, 118 (*male appendages*): Miers, P. Z. S. 1877, p. 137, and Phil. Trans. 1879, p. 490, and Challenger Brachyura, p. 220: Hilgendorf, MB. Ak. Berl. 1878, p. 801: de Man, Notes Leyden Mus. II. 1880, p. 31, and in Weber's Zool. Ergebn. Niederl. Ost.-Ind. II. p. 285: Richters, in Möbius, Meeresf. Maurit. p. 157: Lenz and Richters, Abh. Senck. Nat. Ges. XII. 1881, p. 422: Taschenberg, Zeitschr. f.

Naturwiss. LVI. 1883, p. 171: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 380: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 271.

*Cardisoma Guanhumii* var. *carnifex*, Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 735.

*Cardisoma obesum*, Dana, Proc. Ac. Nat. Sci. Philad. V. 1851, p. 252, and U. S. Expl. Exp. Crust. pt. I. p. 375, pl. xxiv. fig. 1: Milne Edwards, Ann. Sci. Nat., t.c. p. 205: Stimpson, Proc. Ac. Nat. Sci. Philad. 1858, p. 100: Streets, Bull. U. S. Nat. Mus. VII. 1877, p. 114: ? de Man, Notes Leyden Mus. II. 1880, p. 35.

*Cardisoma Urvillei*, Milne Edwards, Ann. Sci. Nat. t.c. p. 204: de Mau, Notes Leyden Mus. t.c., p. 33.

Carapace strongly convex fore and aft, especially in the young, the regions are indicated by inequalities of level, but the posterior limit of the gastric region and the cardiaco-intestinal region are defined by grooves: the posterior areola of the gastric region is always tumid.

The antero-lateral border of the carapace is defined by a fine raised line, becoming indistinct with age, which is not continuous with the small tooth at the outer orbital angle, but starts at a little denticle of its own.

The sides of the front (inner boundaries of the orbit) are very oblique: the sinuous upper border of the orbit runs very slightly backward to the base of the outer orbital tooth: the greatest width (height) of the orbit is little more than half the length of that cavity. The basal antenna-joint is large, touching the front.

The breadth of the buccal cavern, measured across the middle of the external maxillipeds, is equal to its length in the middle line.

In both sexes the chelipeds are unequal: they are smooth, except for a few small tubercles or wrinkles or denticles or granules along the edges of some of the joints: the inner angle of the wrist is dentiform, the palm is higher than long, especially in the larger hand, the stout fingers meet only at tip, especially in the larger hand.

The size of the larger cheliped varies with age. In adults of moderate size it is about twice the length of the carapace, the ischium hardly projects beyond the carapace, and the length of the dactylus is about equal to the height of the palm. In old specimens, especially in the male sex, it is about  $2\frac{3}{4}$  times the length of the carapace, the ischium projects far beyond the carapace, and the length of the dactylus is  $1\frac{1}{2}$  times the height of the palm.

In the legs there are stiff bristles, not very thickly set, at the distal end of the merus, on the anterior border and surface of the carpus and on both borders of the propodite.

The 7th segment of the male abdomen is half or less than half the length of the 6th, measured in the middle line.

In the Indian Museum there are 13 specimens from the Andamans and the Coromandel coast (besides specimens from Tahiti and Madagascar).

Ortmann considers that this form is only a variety of the West Indian *O. Guanhumis*, with which he regards the West African *O. armatum* as synonymous. So far as I can judge from single specimens of these two supposed species, I should think that this view is correct.

### 129. *Ourdiosoma hirtipes*, Dana.

*Cardisoma hirtipes*, Dana, Proc. Ac. Nat. Sci. Philad. 1851, p. 253, and U. S. Expl. Exp. Crust. pt. I, p. 376, pl. xxiv, figs. 2, *a-d*: Milne Edwards, Ann. Sci. Nat., Zool., (8) XX. 1853, p. 205: Hess, Archiv f. Naturges. XXXI. 1865, i. p. 140: Heller, Novara Crust. p. 35: Miers, Cat. Crust. New Zealand, p. 53: de Man, Notes Leyden Mus. II. 1880, p. 34, and Archiv f. Naturges. LIII. 1887, i. p. 349, pl. xiv, fig. 3: E. Nauck, Zeits. Wiss. Zool. XXXIV. 1880, p. 26 (*gastric teeth*): Filhol, Crust. N. Z. in Miss. Pile Campbell, p. 460: Ortmann, Zool. Jahrb., Syst., VII. 1893-94, p. 737: Whitelegge, Mem. Austral. Mus. III. 1897, p. 138: Nobili, Ann. Mus. Genov. (2) XX. 1899, p. 271.

*Discoplas longipes*, A. Milne Edwards, Ann. Soc. Entomol. France, (4) VII. 1867, p. 284, and Nouv. Archiv. du Mus. IX. 1873, p. 294, pl. xv. (*sec* Ortmann, *l.c.*).

This species is easily distinguished from *O. carnifex* by the following characters:—

(1) the carapace is much less convex, the regions are much more distinctly defined, and the gastric region is distinctly subdivided, by grooves, into 3 areolæ: moreover there are some fine oblique striæ on the sides of the epibranchial regions:

(2) the sides of the front, or inner boundaries of the orbit, are not nearly so oblique: the upper border of the orbit is less sinuous and runs slightly forwards to the outer orbital angle: the greatest width of the orbit is nearly two-thirds the length of that cavity. The basal antenna joint does not touch the front:

(3) the breadth of the buccal cavern, measured across the middle of the meri of the external maxillipeds, falls considerably short of the length measured in the middle line:

(4) the chelipeds may be unequal but are far more commonly equal, even in old specimens in which the palms and fingers have grown long and the palm become enlarged:

(5) the bristles on the legs are more thickly set, and they occur along the whole of the anterior border of the merus:

(6) the 7th segment of the male abdomen is more than half the length of the 6th, measured in the middle line.

In the Indian Museum are 18 specimens from the Nicobars and Andamans (besides 4 from the "South Seas" and Madagascar).

In life the carapace is dark violet and the chelæ bright cinnabar red.

#### PELOCARCINUS, Edw.

*Gecarcoidea*, Milne Edwards, Hist. Nat. Crust. II. 25 (1837).

*Pelocarcinus*, Milne Edwards, Ann. Sci. Nat. Zool. (3) XX. 1853, p. 203, and Archiv. du Mus. VII. 1854-55, p. 183: A. Milne Edwards, Nouv. Archiv. du Mus. (3) II. 1890, p. 171 (*et synonym.*).

*Hylæocarcinus*, Wood-Mason, J.A.S.B. XLII. 1873, pt. 2, p. 258, and Ann. Mag. Nat. Hist. (4) XIV. 1874, p. 189.

*Limnocarcinus*, de Man, Notes Leyden Mus. I. 1879, p. 65.

*Gecarcoidea*, Ortmann, Zool. Jahrb., Syst., VII. 1893-94, pp. 732, 738.

Carapace transversely oval, somewhat depressed, with the lateral borders tumid and strongly arched owing to the vault-like expansion of the gill-chambers: the gastric region particularly well defined.

The extent of the fronto-orbital border is less than half the greatest breadth of the carapace, that of the strongly deflexed and nearly straight front is from a sixth to a seventh the greatest breadth of the carapace.

Orbits deep, broadly oval, demarcated dorsally by a sharpish slightly raised border, their outer angle not defined, a wide gap in their lower border: at the inner angle there is a strong tooth which may or may not, even in the same species from the same jungle, meet the front: if it does so, the antennæ, which are much reduced in size, are excluded from the orbit.

The antennules fold obliquely beneath the front, and the inter-antennular septum is not very broad.

Epistome sunken, hairy posteriorly so as to appear ill defined from the palate. Buccal cavern rounded anteriorly, not nearly closed by the external maxillipeds, which leave between them a wide rhomboidal gap in which the mandibles are exposed.

The external maxillipeds are rather short: their merus lies obliquely, and its anterior edge is excavated for the insertion of the palp, which is short and coarse and is completely exposed: their exognath is very short and almost entirely concealed and is without a flagellum. The exognaths of the other maxillipeds are heavily fringed with hair.

Chelipeds much more massive than the legs, usually equal in both sexes, though larger and longer in the male than in the female.

Legs stout: in all, the anterior border of the carpus and all the borders of the propodite and dactylus are spiny, there being six rows of spines on the dactylus.

The abdomen in both sexes consists of 7 separate segments, and in the male its base covers all the breadth of the sternum between the last pair of legs.

The gill-chamber and its lining membrane, and the number of branchiæ, are as in *Cardiosoma*.

The *Pelocarcini* are land-crabs. The single Indian species is very common in the jungles of the Andamans, where, especially on the smaller islets, it grows to a large size.

*Distribution*: Brazil, Andamans and Nicobars, Celebes, Philippines, New Guinea, Loyalty Is.

Ortmann (*l.c.*) throws doubt on the locality Brazil, but, as it appears to me, without sufficient reason, seeing that the elder Milne Edwards states definitely that the type of the species was found in that country by a collector of the Paris Museum. *Pelocarcinus* is by no means the only form of animal life that has this very curious and suggestive distribution, which we also find, among Mammals in the Tapirs, among Birds, as Mr. Finn informs me, in the Piculets of the genus *Picumnus*, among Reptiles in the *Ilysiidæ*, and among fishes in the freshwater eels of the genus *Symbbranchus*.

### 130. *Pelocarcinus Humei* (Wood-Mason).

*Hylæocarcinus Humei*, Wood-Mason, Journ. As. Soc. Bengal, Vol. XLII. 1873, pt. 2, p. 260, pls. xv, xvi, and Ann. Mag. Nat. Hist. (4) XIV. 1874, p. 180.

Carapace transversely oval, becoming broader with age, its lateral borders tumid and ill defined. The gastric region is particularly well delimited and is divided into three subregions—two antero-lateral and one postero-median—the anterior two of which are separated from one another by a deep groove: the cardiac-intestinal region is fairly well defined.

In adults the carapace is smooth, except for some oblique striæ on the lateral borders, which become squamiform markings on the pterygostomian regions, these regions being devoid of tomentum.

Front nearly vertically deflexed, somewhat spatulate but with the free edge straight. The tooth at the inner angle of the orbit does not usually touch the front, but sometimes it does and excludes the small antennæ from the orbit.

The chelipeds in the adult male are usually equal and are about  $2\frac{1}{2}$  times the length of the carapace: the arm projects a long way beyond the carapace, and its upper and inner borders are rugose or irregularly tuberculate; the inner angle of the wrist is truncated; the palm is enlarged, its length is about  $1\frac{1}{2}$  times its height and about as long as the

dactylus; the fingers, though they only meet at tip, are not widely separated.

In the adult female the chelipeds are about  $1\frac{1}{2}$  times the length of the carapace: the arm projects but little, the hand is not much enlarged, and the fingers almost meet throughout their length.

In many young females the inner edge of the wrist is serrated and there are also a few denticles along the upper border of the palm.

The second pair of legs, which are the longest, are hardly twice the length of the carapace.

Colours in life: carapace violet with some dirty yellow markings: chelipeds and legs yellowish with a livid reddish tinge.

In the Indian Museum are specimens from the Nicobars and from numerous islands of the Andaman group. The largest one has a carapace 82 millim. long and 110 broad.

### Family PALICIDÆ, Rathbun.

#### PALICUS, Philippi.

*Cymopolia*, Roux, Crust. Médit. pl. xxi. 1828: Milne Edwards, Hist. Nat. Crust. II. 158: Miers, Challenger Brachyura, p. 333 (*nom præocc.*).

*Palicus*, Mary J. Rathbun, Proc. Biol. Soc., Washington, XI, 1897, pp. 98, 165 ["Philippi, Zweiter Jahresber. d. Vereins f. Naturk. in Cassel, 11, 1838."].

Carapace depressed, broader than long, covered with granules and with symmetrical tubercles or rugosities that have a tendency to fall into transverse series.

Front about a third the greatest breadth of the carapace, little or not at all deflexed, usually lobed or toothed. Lateral borders of the carapace hardly curved, serrated anteriorly.

Orbits deep, the upper border is cut into several teeth by deep clefts, and there are usually two clefts in the lower border.

The antennules fold nearly transversely beneath the front: the interantennular septum is a narrow plate. The antennæ commonly have the basal joint, which stands in the orbital hiatus, enlarged: the flagellum is well developed.

Epistome sunken, not defined. Buccal cavern square. The external maxillipeds do not close the buccal cavern anteriorly: their merus is very small and is much narrower than the ischium: the ischium has its antero-internal angle and the merus its antero-external angle much produced: the palp articulates near the middle of the concave summit of the obliquely-placed merus.

Chelipeds short and usually slender in the female: in the adult male one of them may be enlarged—rarely both.

The two middle pairs of legs are much the largest: the first pair, except that they are much shorter and slenderer, resemble the middle pairs, but the fourth pair are weak, sometimes filiform, and are elevated above the third pair as in *Dorippe*, etc.

The abdomen in both sexes consists of 7 separate segments, the basal segments being very narrow fore and aft and the 1st linear.

In the female the genital openings are on the 2nd segment of the sternum close to the suture between it and the first.

*Distribution*: Atlantic coasts of Central America and of the United States, Cape Verde and Mediterranean, Indo-Pacific from Seychelles to California.

The Indian species of *Palicus* live among coral shingle at a depth of from 10 to 40 fathoms, where their mottled coloration and granular rugose carapace afford a good concealment.

*Key to the Indian species of Palicus.*

- I. Posterior border of the propodites and dactyli of the first 3 pairs of legs entire:—
1. Front cut into two lobes:—
    - i. Lobes of front broad: propodites and dactyli of the two middle pairs of legs sub-foliaceous..... *P. Jukesii.*
    - ii. Lobes of front subacute: propodites and dactyli of the two middle pairs of legs compressed but not broadened ..... *P. Whitei.*
  2. Front cut into four lobes, the middle two sub-acute, the outer ones broad..... *P. Wood-Masoni.*
- II. Posterior border of the propodites and dactyli of the first 3 pairs of legs elegantly serrate:—
1. Front cut into four blunt teeth: propodites and dactyli of the two middle pairs of legs broadly foliaceous ..... *P. serripes.*
  2. Front cut into four acute teeth: propodites and dactyli of the two middle pairs of legs compressed but not foliaceous ..... *P. investigatoris.*

131. *Palicus Jukesii* (White).

*Cymopolia Jukesii*, White, in Jukes' Voy. H. M. S. "Fly," p. 338, pl. ii. fig. 1: Miers Zool. H. M. S. "Erebus" and "Terror," Crust. p. 3, pl. iii. figs. 4-4c, and Challenger Brachyura, p. 335: Haswell, Cat. Austral. Crust. p. 138: Henderson, Trans. Linn. Soc., Zool., (2) V. 1893, p. 405.

Carapace with the regions well defined, and with the surface thrown into four transverse wrinkles, the two middle ones of which are the most convex and best defined: the whole surface is also closely

covered with vesiculous and crystalline granules, which are largest on the convexities.

Front divided into two broad rounded lobes: antero-lateral border of the carapace cut into three teeth including the orbital angle: posterior border of the carapace raised, but not cut into well-spaced lobules.

Upper border of the orbit with two deep notches between the inner and outer orbital angles, both of these angles having a concave margin: lower border with two deep notches. There is a leaf-like lobule on the granular eye-stalk, another at the outer angle of the basal antenna-joint, and another in the gap between the antenna and the outer angle of the buccal cavern. The exposed surface of the ischium of the external maxillipeds is obliquely traversed by two ridges which meet at the produced antero-internal angle of the joint.

The chelipeds of the *adult* male are granular and downy and are usually markedly unequal. The larger one is stout, is more than  $1\frac{1}{2}$  times the length of the carapace and has a swollen (subcylindrical) club-shaped palm of which the length is not twice the greatest height: the fingers are short and stumpy, the dactylus being little more than a third the length of the palm, and meet only at tip: the smaller cheliped of the male is short and slender, sometimes however it is almost as large as its fellow.

In the female the chelipeds are equal, are hardly longer than the carapace and hardly stouter than the last pair of legs: they have a palm which is as slender and nearly as long as the ischium, and incurved fingers which nearly meet throughout their length.

In the first 3 pairs of legs the merus is stout and broad with a granular dorsal surface and coarsely and unevenly serrulate edges, the anterior edge ending in a crest-like tooth; the carpus is dorsally carinate, and its anterior border has the form of a two-lobed carina; and the propodite and dactylus are subfoliaceous owing to the depth of the thin sharp carinæ of their edges—these carinæ being plumed. The 4th pair of legs are short weak and granular as far as the dactylus, which is much shorter than the propodite.

The 1st pair of legs are a little longer, the 4th pair a little shorter, than the carapace: the 2nd and 3rd pairs are about  $1\frac{2}{3}$  times the length of the carapace.

In both sexes all the abdominal terga, except the last, are transversely carinate, the carinæ of the 2nd and 3rd terga being most conspicuous. Also on either side of the sternum there are two crests, one behind the base of the last pair of legs, the other almost in a line with the 3rd abdominal carina.



In the Indian Museum are 32 specimens, from the Andamans (up to 36 fath.), the Maldives (15–30 fath.), and Ceylon (34 fath.). The carapace of the largest female is 13 millim. long and 15 broad.

132. *Palicus Whitei* (Miers).

*Cymopolia Whitei*, Miers, Zool. H. M. S. "Alert," pp. 518, 551, pl. xlix. fig. C.

At once distinguished from *P. Jukesii*, which it closely resembles, by the sharper and more prominent lobes of the front, and by the slenderer form of the first 3 pairs of legs, in which the edges of the meri are not serrated, the anterior borders of the carpi are not cristiform, and the propodites and dactyli are not in any way subfoliaceous, their edges not being produced to form high thin carinæ.

Other differences, to be noted on closer inspection, are the following:—

The transverse arrangement of the rugæ of the carapace is not marked: the faint transverse carinæ of the 5th and 6th abdominal terga are absent.

In the Indian Museum are 2 adult females and a non-adult female, from the Andamans.

133. *Palicus Wood-Masoni*, n. sp.

Carapace with the regions distinct and areolated in high relief: except posteriorly, the areolæ have no tendency to arrange themselves transversely: the convexities of the areolæ, but not the interspaces, bear clumps of crystalline granules.

Front cut into 4 teeth, the middle pair narrower, slightly more prominent, and on a rather lower plane than the others: lateral border of the carapace cut into three teeth, including the very large and acute orbital angle: posterior border raised and irregularly lobulate.

In the upper border of the orbit there are three deep notches, in the lower border a notch and a fissure.

There is only one cheliped in the single specimen known: it is short, not stouter than the legs, and has some blunt denticles on the far end of the arm, on the wrist, and on the upper surface of the hand.

In the first 3 pairs of legs the meri are stout and have a granular dorsal surface and coarsely serrulate edges, the anterior edge ending in a coarse spine; the carpi are dorsally carinate, and their anterior edge has the form of a two-lobed crest; while the propodites and dactyli are elongate and compressed with thin, but not cristiform, plumed edges. The filamentous 4th pair are granular up to the dactylus, which is not much shorter than the propodite.

The 1st pair of legs are about  $1\frac{1}{2}$  times, the 2nd and 3rd pairs are about  $2\frac{1}{4}$  times, the length of the carapace, while the 4th pair are about as long as the carapace.

In the male (female unknown) the first 5 abdominal terga are transversely carinated, but the 4th and 5th carinæ are faint. The sternum is also carinated on either side of the abdomen, as in *P. Jukesii*, but the crests are much lower.

In the Indian Museum is a single male specimen from the Andamans: its carapace is 9 millim. long and 11 broad.

#### 134. *Pulicus serripes*, Alcock & Anderson.

*Cymopolia serripes*, Alcock & Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 208: Illustrations of the Zoology of the Investigator, Crust. pl. xxiv. fig. 7.

Carapace with the regions well defined and cut up into a multitude of symmetrical convex areolæ, its whole surface is covered with crystalline granules which are enlarged on the convexities of some of the areolæ.

Front cut into 4 teeth, the middle two of which, though deflexed and on a lower plane, are much sharper and more prominent than the others: lateral borders of the carapace posteriorly divergent, cut into five ragged teeth, inclusive of the orbital angle: posterior border cut into from eight to ten well spaced even tooth-like lobes.

Upper border of orbit with 3 deep notches, lower border with a notch and a fissure: eyestalks sharply granular. Ischium of the external maxillipeds longitudinally grooved.

The chelipeds of the female (male unknown) though shorter than the carapace are stouter than the first pair of legs: they may be subequal or unequal: the arm, wrist, and the upper surface of the palm are sharply granular, the palm is rather full and is not elongate, being about half again as long as high and less than half again as long as the fingers.

The 1st pair of legs are about as long as the carapace: their merus is sharply granular and its anterior border ends in a spine: their propodite and dactylus are thin and compressed but not broadened, and their posterior border is evenly serrated.

The 2nd and 3rd pair of legs are a little over  $1\frac{1}{2}$  times the length of the carapace: their merus is very stout and broad, with a granular dorsal surface and sharply though irregularly serrated edges: their carpus has the anterior border cristiform and irregularly serrate, and the posterior border subcristiform up to a terminal spine: their propodite and dactylus are short and broadly foliaceous, with the posterior

border elegantly and evenly serrated and the anterior border fringed with long hair.

The 4th pair are filiform, not nearly as long as the carapace, and are granular up to the dactylus which is slightly longer than the propodite.

In the female the first 3 abdominal terga are transversely carinate: the carina of the first tergum, which alone is prominent, ends off in a sort of scroll, which flanks the postero-lateral angles of the carapace.

In the Indian Museum are 9 specimens, all adult females, from off the Madras coast in the neighbourhood of Palk Strait and from off Ceylon 34 fathoms. The carapace of the largest is 9.5 millim. long and 11 broad.

### 135. *Palicus investigatoris*, n. sp.

This species is closely related to *P. serripes*, but differs in the following characters:—

The areolæ of the carapace are capped, not by clusters of granules, but by sharp little tubercles between which the surface is smooth: except on the lateral regions of the carapace there is only one such tubercle to each areola:

(1) the four teeth of the front are all equally acute: the five teeth of the lateral borders of the carapace, though irregular in size, are all very sharp and clean cut: the teeth of the posterior border are smaller and sharper:

(2) there is no fissure towards the inner end of the lower border of the orbit:

(3) there are denticles or sharp tubercles, instead of granules, on the arm, wrist, and upper surface of the hand:

(4) the legs only differ in the case of the 2nd and 3rd pairs in which none of the joints are so broad: the serration of the edges of the merus is different, the terminal spine of the anterior border being greatly enlarged; the anterior border of the carpus has a spine at each end, but is not otherwise serrated; and the dactylus and propodite, though thin and compressed, and otherwise quite like those of *P. serripes*, are not broadened, being much less foliaceous.

In the Indian Museum is a single non-adult male from off the Andamans: its carapace is nearly 7 millim. long and 8 millim. broad.

### Family PTENOPLACIDÆ.

#### PTENOPLAX, Alcock & Anderson.

*Archæoplax*, Alcock and Anderson, Journ. As. Soc. Bengal, Vol. LXIII. pt. 2, 1894, p. 180.

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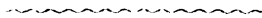
*Ptenoplas*, Alcock and Anderson, Illustrations of the Zoology of the Investigator, Crust. pl. xv. 1895 : Alcock, Investigator Brachyura, p. 78.

As the generic diagnosis has already been published in this Journal (*loc. cit.* *Archæoplax*) the above references are sufficient.

136. *Ptenoplas notopus*, Alcock & Anderson.

*Archæoplax notopus*, Alcock and Anderson, Journ. As. Soc. Bengal, LXIII. pt. 2, 1894, p. 181, pl. ix. fig. 3.

*Ptenoplas notopus*, Alcock and Anderson, Ill. Zool. Investigator, Crust., pl. xv. fig. 2 : Alcock, Investigator Brachyura, p. 79.



# JOURNAL

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## ASIATIC SOCIETY OF BENGAL.



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XVII.—*The relationship of the water-supply, water-logging, and the distribution of Anopheles Mosquitos respectively, to the prevalence of Malaria north of Calcutta.*—By LEONARD ROGERS, M.D., M.R.C.P., I.M.S., Professor of Pathology, Medical College.

[ With a Map. ]

[ Received and read 4th July, 1900. ]

The tract of country in which the present inquiry was carried out extends along the East bank of the Hooghly river from Calcutta to Naihati, a distance of 25 miles. The area is fairly typical of Lower Bengal, and has for a long time been looked on as water-logged and very malarious. In 1889 Dr. Gregg, then Sanitary Commissioner of Bengal, after a careful inspection, came to the conclusion that the unhealthiness was due to certain drainage channels having been silted up, and a scheme for re-excavating some of them was prepared, but has not yet been carried out. Owing to an unusual prevalence of fever in 1899 a further inquiry into the health of the tract was ordered, and was carried out by me in February last.

The plan of the enquiry was as follows. As the essential point to be determined was the proportion of the inhabitants of the various parts of the area who were suffering from malaria, a large number of persons were examined for enlargement of the spleen; its size being noted as either just felt, two fingers breadth below the ribs, four fingers breadth below, or extending beyond the navel. The spleen-count as a test for the degree of malaria in a tract of country was

used by Major Dyson in the Punjab in a similar inquiry, and by others, and is perhaps the most reliable and easily carried out method, especially in the season of the year when fever is at a minimum. Secondly, the level of the ground-water was taken in as many wells as possible, and inquiries were made as to the height to which the ground-water rose during the rainy season, so as to enable the degree of water-logging to be estimated. Thirdly, the drinking-water supply was carefully noted. Fourthly, the number of fever cases treated at various dispensaries month by month was compared with the monthly rainfall over a series of years, and worked out in charts, in order to ascertain the influence of seasons and rainfall on the fever rate. Lastly, some observations have been made on the distribution and monthly variations of the distribution of the *Anopheles* Mosquitos, which have furnished some rather surprising results.

In carrying out the spleen-count the whole area was divided up into thirteen Municipalities, and as far as possible 100 persons, about half of whom were children, were examined in each Ward of each Municipality, over 5,000 persons having been examined in all. As children suffer from enlarged spleen more commonly than adults, just as Koch has recently shown that the malarial organism is also found in a larger percentage of children, the figures have been corrected so as to represent the spleen rate of 50 children and 50 adults in each Ward, so that the figures of the different areas should be strictly comparable. Visits were made from house to house so as to get a fair sample of the actual inhabitants of the Wards, and every precaution was taken to obtain accurate results, every single person being examined by myself, a month being taken over the inquiry.

The results are embodied in the accompanying map, in which the different municipal areas are shaded in accordance with the percentage of persons who were found to have enlarged spleens, the darker areas representing the highest percentages and *vice versa*. The dotted lines within the municipal areas enclose the Wards or areas separately examined, and the large figures within them indicate the spleen percentage, while the figures enclosed in a circle are those of the distance of the ground water-level below the surface in feet and inches, the upper figures being the distance in the dry cold weather taken in the month of February, while the lower ones indicate the distance during the height of the previous rainy season. The small figures in brackets refer to the number of the Wards given in the left-hand margin of the map, and correspond with those in the tables given further on.

#### THE GENERAL RESULTS OF THE SPLEEN-COUNT.

The following table shows the percentage of people who were found

to be suffering from enlarged spleen in each Municipality. They are arranged in order from above downwards as they are situated on the map from north to south, while the westernly ones, which lie on the east bank of the Hooghly, are placed on the left, and the easternly ones, which are at a little distance from the river, are placed in the right-hand column, so that the table roughly represents their position on the map.

TABLE I.

| Municipality.            | Spleen percentages. | Municipality.            | Spleen percentages. |
|--------------------------|---------------------|--------------------------|---------------------|
| Naihati ... ..           | 19·9                | (Gobardanga) ... ..      | (55·5)              |
| Bhatpara ... ..          | 20·0                |                          |                     |
| Garulia ... ..           | 33·8                |                          |                     |
| North Barrackpore ...    | 36·5                | (Busirhat) ... ..        | (52·8)              |
| Titagarh ... ..          | 37·8                | Baraset ... ..           | 52·9                |
| South Barrackpore (West) | 25·2                | South Barrackpore (East) | 56·0                |
| Kamarhati (West) ...     | 18·8                | Kamarhati (East) ...     | 34·8                |
| Baranagar ... ..         | 17·8                | North Dum Dum ...        | 68·1                |
| Chitpore-Cossipore ...   | 11·2                | South Dum Dum ...        | 32·3                |
|                          |                     | Maniktolla ... ..        | 13·2                |
| Average ... ..           | 24·5                | Average ... ..           | 41·0                |

A glance at the above table or at the shaded map will show that the places situated on the bank of the Hooghly river have a much lower spleen percentage than those further to the east, even when the latter are but two miles from the river as in the case of the last five in the right-hand column of the table, with the exception of part of North Dum Dum. This having been ascertained, the question arose whether the lower rate on the banks of the Hooghly was to be regarded as the normal rate, and the higher figures of the inner tract as being due to water-logging or other abnormal conditions, or whether the latter must be taken as the usual state of affairs in this part of Lower Bengal, and the banks of the Hooghly as being exceptionally healthy. In order to solve this problem it was necessary to visit other places still further to the east, and Gobardanga and Basirhat, which are situated on the next flowing river to the east of the Hooghly, namely, the Ichahamati, were selected as the most suitable for the purpose. The former is some 20 miles to the east of Naihati, while the latter is 26 miles to the east of Baraset. The former is nearly surrounded by a bend of the river on two sides and by marsh land on the other sides, so that cannot be considered to be well situated from the health point of view, but Basirhat, on the other hand, would appear to be likely to be as healthy as any place in this portion of the Gangetic delta. Nevertheless, both show a spleen-rate of over 50 per cent., which, agreeing as it does with Dr. Gregg's statements about this tract of country, may be taken as

approximately the normal figure for this part of Lower Bengal. It would, therefore, appear that the east bank of the Hooghly is exceptionally healthy, although some of the Municipalities in the low-lying tract a little to the east of the river show very high spleen-rates, more especially North Dum Dum and the portion of South Barrackpore to the east of the railway, whose figures are 68 and 56 per cent. respectively. It may also be at once mentioned that last year, namely, 1899, was an exceptionally feverish one on account of the excess and uneven distribution of the rainfall.

On looking more closely at the figures it will be observed that there is one marked exception to the rule above pointed out, for Maniktolla, although situated away from the river-bank and on extremely low-lying and water-logged land, has, nevertheless, the second lowest spleen-rate; an exception which has proved to be the key to a very important factor in the causation of the variations of the spleen-rate in the tract under consideration. The only ground on which the low spleen-rate of Maniktolla can be accounted for is the enjoyment by this advanced Municipality of a good filtered water supply. It is also worthy of note that Chitpore-Cossipore, which has the lowest rate of all, namely, 11·2, has the double advantage of a filtered water supply and a situation on the east bank of the Hooghly. That these are the true reasons of its marked immunity is shown by the fact that the average rate of the two western Wards is only 7·4, while that of the two easterly Wards, situated from one to two miles from the river, is 14·7, that is almost the same as that of Maniktolla. The density of the population of Chitpore, and consequent smaller number of tanks, etc., may also be a slight factor in its healthiness, but the details to be given immediately with regard to the spleen-rates of different parts of Maniktolla and other places show that this is not a factor of any great importance, but on the other hand they will prove conclusively the intimate relationship between a filtered water-supply and a low spleen rate, but as this point is one of the utmost practical importance it will be necessary to go somewhat into detail with regard to the spleen-rates of different Wards of the same Municipalities, more especially of those parts of which are being supplied with good water by mills situated within their boundaries. At the same time the data with regard to the ground water-levels will be given, so that the question of water-logging can also be discussed.

WARD VARIATIONS IN THE SPLEEN-RATES. 1. MANIKTOLLA.—This Municipality, as will be evident from the accompanying map, is situated between the Circular and the New Cut Canals, and this area is so flat that there is only a fall of some eight feet from west to east in a distance of two miles. Its drainage is dependant on channels by the



sides of the four main roads, and is carried under the New Cut Canal by means of siphons into the Great Salt Water Lake, but these have to be closed at high tides to prevent the salt water running up into the drains, and they do not work very efficiently at present. The portion of the main drains in the western and more densely populated portion of the Municipality are brick-lined, but the eastern portions are of earth only. The water-level was taken in several wells, and in February it was found to average 5 feet from the surface of the ground, while evidence was obtained that it rises to within from one to two feet during the rainy season. A more typically water-logged place it would be difficult to find. For purposes of comparison it was divided up into western and eastern portions, and the spleen-rates were found to be 12·4 for the former and 14 for the latter, although it might have been expected that the less densely inhabited and more water-logged eastern portion would have had a decidedly higher rate. It was in the west part of this Municipality also in which the larvæ of the malarial-bearing mosquito was found in from half to two-thirds of the tanks as well as in some other pools, as will be detailed further on, so that none of the known causes of malaria were absent, in spite of which this Municipality, together with that of Chitpore and Cossipore, were the two which showed considerably the lowest spleen-rates of all the thirteen, and these two are the only ones which have a full filtered water supply.

The following table shows the above figures in a convenient form.

TABLE II.

## MANIKTOLLA.

| Area.         | Ground Water-Level. |              | Water-supply. | Corrected Spleen percentages. |           |                |
|---------------|---------------------|--------------|---------------|-------------------------------|-----------|----------------|
|               | Feb., 1900.         | Rains, 1899. |               | Adult Males.                  | Children. | General Total. |
| West part (1) | 5 ft.               | 1 to 2 ft.   | Filtered.     | 13                            | 11·8      | 12·5           |
| East (2)      | 5 ft.               | 2 ft. 6 in.  | do.           | 13                            | 15·0      | 14·0           |

CHITPORE-COSSIPORE.—This Municipality is situated immediately to the north of Calcutta, and extends eastwards as far as the Eastern Bengal Railway and northwards to the southern border of Baranagar. It is divided into four Wards, namely, Chitpore and Cossipore West extending from the river to the Grand Trunk Road, the spleen percentages of which are 4·8 and 9·9 respectively; and Chitpore and Cossipore East, extending from the Grand Trunk Road to the Railway, and consequently distant from one to two miles from the river bank, the spleen-rates of which are 13 and 16·75 per cent. respectively. The whole area is supplied fully with filtered water, while those people who do not drink this (and they are certainly a decided minority)

will take chiefly river water in the western Wards, and tank water in the eastern ones. The water-level in three wells varied only between 4 and 5 feet from the surface in February, and in the rainy season it had been within from 1 to 2 feet of it; so that here again there was considerable water-logging but the minimum amount of fever, while although the western portion is more densely populated, the eastern part presents numerous tanks, and is generally favourable to the development of malaria, yet, apparently owing to the filtered water-supply, the spleen-rate is very low.

TABLE III.

## CHITPORE-COSSIPORE.

| Area.               | Ground Water-Level. |              | Water-supply. | Corrected Spleen percentages. |           |                |
|---------------------|---------------------|--------------|---------------|-------------------------------|-----------|----------------|
|                     | Feb., 1900.         | Rains, 1899. |               | Adult Males.                  | Children. | General Total. |
| Chitpore, West (3)  | 4 ft. 3 in.         | 1 ft.        | Filtered.     | 2·05                          | 7·7       | 4·85           |
| Cossipore, West (4) | 4 ft. 9 in.         | 2 ft. 9 in.  | do.           | 10·6                          | 9·3       | 9·95           |
| Chitpore, East (5)  | 5 ft. 1 in.         | 2 ft.        | do.           | 16·0                          | 10·0      | 13·00          |
| Cossipore, East (6) | .....               |              | do.           | 18·3                          | 15·2      | 16·75          |

**SOUTH DUM DUM.**—To the east of the railway, which bounds the Chitpore-Cossipore Municipality, lies South Dum Dum, the most thickly inhabited portions of which are situated on the Jessore, Belgatia and Dum Dum roads, and it is divided into three Wards, which may roughly be taken as respectively including the parts adjoining these three roads. The inhabitants of Ward II who were examined mostly resided near the easternmost portion of the Dum Dum road, and the spleen rate was 37·9. Those of Ward I. mostly lived around that portion of the Jessore road which joins the eastern ends of the Belgachia and Dum Dum roads, and its spleen-rate was 45·3. Lastly, most of those examined in Ward III. lived around the western end of the Belgachia road just to the east of the railway, and consequently close to the Western Ward of Cossipore, and the spleen-rate among them was only 13·7, by far the lowest rate of any place to the east of the railway. Here again the probable explanation of this exception is that many of the inhabitants of this Ward obtain filtered water from the Cossipore Municipality as I ascertained both by inquiry and by seeing them carrying the water myself, while the portion of the other Wards which were examined were too far from Cossipore for the people to resort there for water to any extent. The conditions favourable to malaria are very similar in each Ward, for the Bajulla Khal flows right through Wards II. and III. as a broad swampy track with little or no current except during the rainy season, while the tide flows up it from the Salt Water Lakes at high water,

there being no sluice gate where it passes through the bund, while part of the houses of the Municipality are surrounded by rice fields. The water-level in a well in Ward I. was 8 ft. 9 in. below the surface in February, while during the previous rainy season it had risen within 9 inches of the ground, when the water could be dipped out by hand without the use of any rope, so that there is no doubt about this Municipality being very water-logged.

TABLE IV.  
SOUTH DUM DUM.

| Ward.    | Ground Water-Level. |              | Water-supply.    | Corrected Spleen percentages. |           |                |
|----------|---------------------|--------------|------------------|-------------------------------|-----------|----------------|
|          | Feb., 1900.         | Rains, 1899. |                  | Adult Males.                  | Children. | General Total. |
| I. (7)   | 8 ft. 9 in.         | 1 ft.        | Tank.            | 41·8                          | 48·8      | 45·3           |
| II. (8)  | ...                 | ...          | do.              | 35·4                          | 40·4      | 37·9           |
| III. (9) | ...                 | ...          | Partly filtered. | 11·8                          | 15·6      | 13·7           |

BARANAGAR.—This Municipality lies between the Hooghly and the Eastern Bengal Railway, extending northwards for nearly two miles above Cossipore. It is divided into four Wards, the first three of which are between the river and the Grand Trunk Road, and the fourth lies to the east of the former, being mostly between the Grand Trunk Road and the railway, and consequently is dependant for its water-supply on tanks, while the first three get theirs mainly from the river, although Ward I., which is the most southernly bordering on Cossipore, obtains a certain amount of filtered water from that Municipality. Ward I. has the lowest spleen-rate, it being only 11·6, Wards II. and III. have intermediate rates of 14·3 and 18·1 respectively, while Ward IV. has the highest rate, namely, 26; differences which can only be explained by the varying water-supply, for although the last Ward also has a larger area under rice cultivation, that portion of it, whose inhabitants were examined, did not present materially different conditions from the other three Wards. Nor will the differences in the ground water-level, which are given in the Table below, account for those of the spleen-rates.

TABLE V.  
BARANAGAR.

| Ward.     | Ground Water-Level. |              | Water-supply.                   | Corrected Spleen percentages. |           |                |
|-----------|---------------------|--------------|---------------------------------|-------------------------------|-----------|----------------|
|           | Feb., 1900.         | Rains, 1899. |                                 | Adult Males.                  | Children. | General Total. |
| I. (10)   | 7 ft. 7 in.         | 4 ft.        | River and Tank & some filtered. | 15·0                          | 8·3       | 11·6           |
| II. (11)  | 4 ft. 1 in.         | 2 ft.        | River and Tank.                 | 12·3                          | 16·3      | 14·3           |
| III. (12) | 7 ft. 6 in.         | 3 ft.        | do. do.                         | 22·9                          | 13·4      | 18·1           |
| IV. (13)  | ...                 | ...          | Tank only.                      | 14·6                          | 37·3      | 26·0           |

**KAMARHATI.**—This Municipality lies immediately to the north of Baranagar, and consists of two Wards, namely, No. I. between the river and the Grand Trunk Road, and No. II. from the latter up to the Eastern Bengal Railway, and including Belguria. The spleen-rate of the river Ward was found to be 18·8, while that of the inland Ward was 34·8, a notable difference, while the first Ward mainly relies on the river for its water-supply, and the latter is dependant on tanks; for although there are a few wells in all the municipalities, mostly belonging to private individuals, yet they appear from my inquiries to be little if at all used by the people for drinking purposes, especially if filtered water is available, while many intelligent natives informed me that those who drank filtered water suffered much less than those who drank that from any other source, including well water. The ground water was 7 feet below the surface in February in the riverine Ward, and had been within 1 ft. 8 in. of it in the rainy season of 1899, while it was 1 foot further down in both seasons in the case of the eastern Ward, so that from this point of view the latter should have been slightly the more healthy of the two, instead of entirely the reverse obtaining.

TABLE VI.

## KAMARHATI.

| Ward.         | Ground Water-Level. |              | Water-supply.   | Corrected Spleen percentages. |           |                |
|---------------|---------------------|--------------|-----------------|-------------------------------|-----------|----------------|
|               | Feb., 1900.         | Rains, 1899. |                 | Adult Males.                  | Children. | General Total. |
| I. (14) West  | 7 ft.               | 1 ft. 8 in.  | River and Tank. | 17·3                          | 20·4      | 18·8           |
| II. (15) East | 8 ft.               | 2 ft. 8 in.  | Tank only.      | 32·5                          | 36·6      | 34·8           |

**NORTH DUM DUM.**—This Municipality is situated to the east of Kamarhati, and extends from the railway to Nowi Nadi, a distance of some four miles, and it consists for the most part of rice fields surrounding several villages. It contains two Wards, the westernly of which includes the large village of Nimta, while the easternly one includes Gouripur and Kadihati, which are situated on the Nowi Nadi, a sluggish stream which carries the surface drainage away to the south-east into the Kocho bhil. The water-level in a well in the western Ward was 7 ft. 3 in. below the surface in February, and had risen to within 2 ft. 3 in. in the rainy season of 1899, so that this part is certainly water-logged. The spleen-rate in the western Ward was no less than 76·6 per cent., while among 58 boys of the Nimta High School, who mostly belonged to well-to-do families, it was 67. In the eastern Ward the percentage worked out at 59·6, which is also very high, the average of the two Wards being 68·1; an extremely high figure. The water-supply is

solely from tanks and a very few wells, while the villages are surrounded by flooded rice fields during the rainy season; both a bad water-supply and water-logging being present and factors in causing the marked unhealthiness of this area.

TABLE VII.

## NORTH DUM DUM.

| Ward.        | Ground Water-Level. |              | Water-supply. | Corrected Spleen percentages. |           |                |
|--------------|---------------------|--------------|---------------|-------------------------------|-----------|----------------|
|              | Feb., 1900.         | Rains, 1899. |               | Adult Males.                  | Children. | General Total. |
| Western (16) | 7 ft. 3 in.         | 2 ft. 3 in.  | Tank          | 73·3                          | 80·6      | 76·6           |
| Eastern (17) | ...                 | ...          | do.           | 56·6                          | 62·5      | 59·6           |

SOUTH BARRACKPORE.—This Municipality is a very large and scattered one, mainly consisting of a riverine portion situated between the Hooghly and the Grand Trunk Road, the following four Wards of which (beginning from the south) were examined, namely; Agarpura, with a spleen-rate of 30·8 and a ground water-level of 7 ft. in February and 1 ft. 8 in. below the surface in the rains of 1899: Punihati, with a spleen-rate of 31·25: Sukchar, with a spleen-rate of 12·1 and a ground water-level of 8 ft. in February, and 2 ft. below the surface in the rains of 1899: and Khardaha, situated just to the south of the khal of the same name, with a spleen-rate of 26·75 and a ground water-level of 6 ft. 6 in. down in February. All these depend mainly for their water-supply on the river, while the exceptionally low rate of Sukchar appears to be due to the unusual number of good pukka houses, many of which are two stories high, the inhabitants of which must have been much better to do than the majority of those in most of the other Wards, while tanks are also fewer than usual in this Ward.

This Municipality also includes a large area of rice land with scattered villages to the east of the Grand Trunk Road, and extending across the Eastern Bengal Railway. Two portions of this were examined, namely, one to the east of Punihati and Sukchar, consisting mainly of the village Sodepore on either side of the Eastern Bengal Railway, but mostly to the east of it, and another village called Natagore to the east of the former. The spleen-rate of this area was 60·4, that of Sodepore having been 61·7, and that of Natagore 64·4. The ground water-levels in February were 10 ft. 6 in. and 9 ft. respectively, and in the rainy season of 1899, 2 ft. and 4 ft. below the surface, measurements which, it will be observed, are very similar to those of the riverine portions of this Municipality, the slight difference being in favour of the inland portions, although their spleen-rates are very much higher than those of the parts on the banks of the

Hooghly, so that the water-levels do not help in explaining the difference. On the other hand, the dwellers near the river will mostly drink river water, while those who live more inland are entirely dependant on tank water. The other part of the South Barrackpore Municipality which was examined lies to the east of the railway opposite North Barrackpore, and consists of the villages of Chandanpukuria and Nona. The spleen-rate was found to be 51·6, while the ground water-level was 10 ft. 4 in. below the surface in February, but had risen to within 5 ft. during the rains of 1899, figures which are much more favourable than those of Maniktolla and Chitpore-Cossipore, which have the lowest spleen-rates. This, the most north-eastern Ward of the South Barrackpore Municipality, is also dependant on tank water for its drinking supply. The much lower spleen-rate, then, of the parts near the river, as compared with those at a distance of two miles or more from it, is again borne out by this Municipality, the figures of which are given in the table below.

TABLE VIII.

## SOUTH BARRACKPORE.

| Area.         | Ground Water-Level. |              | Water-supply.  | Corrected Spleen percentages. |           |                |
|---------------|---------------------|--------------|----------------|-------------------------------|-----------|----------------|
|               | Feb., 1900.         | Rains, 1899. |                | Adult Males.                  | Children. | General Total. |
| Agarpara (18) | 7 ft.               | 1 ft.        | River and Tank | 33·3                          | 28·5      | 30·8           |
| Punihati (19) | ...                 | ...          | do. do.        | 20·0                          | 42·5      | 31·2           |
| Sukchar (20)  | 8 ft.               | 2 ft.        | do. do.        | 19·3                          | 6·9       | 12·1           |
| Khardaha (21) | 6 ft. 6 in.         | ...          | do. do.        | 32·5                          | 21·0      | 26·7           |
| Sodepore (22) | 9 ft.               | 4 ft.        | Tank only.     | 50·0                          | 70·9      | 60·4           |
| Nona (23)     | 10 ft. 4 in.        | 5 ft.        | do.            | 36·5                          | 66·8      | 51·6           |

TITTAGHAR.—This is a small Municipality which lies on the east bank of the Hooghly between South and North Barrackpore, and is bounded on the south by the Khardaha Khal, and on the north by the Tittaghar Khal, and on the east by the Grand Trunk Road. It is divided into four Wards numbered I. to IV. from north to south. Two Mills in Wards II. and III. supply a limited amount of filtered water more especially to the inhabitants of Ward II., but Wards I. and IV. on either side of the other two drink nearly entirely river and tank water. Here, then, was a very good opportunity of putting to a crucial test the question as to whether filtered water drinkers suffer less from enlargement of the spleen than do those who drink other kinds, so notes were made regarding nearly all of the people examined in this Municipality as to what water they usually drunk, whether filtered, Hooghly, or tank.

The results are as follows, beginning from the south as before. Ward IV., which is a narrow strip situated on the north bank of the Khardaha Khal, up to which the tidal water flows as far as a sluice gate in a bridge under the Grand Trunk Road, and which contains a series of bustees, had a spleen-rate of 48 per cent., that is a high one for a riparian area. The water-level was 10 ft. 1 in. below the surface in February, but had risen to within 1 ft. 3 in. in the rains of 1899. Only 16 per cent. of those who were examined stated that they drank filtered water. In Ward III. 32 per cent. of those examined had drunk filtered water, and the spleen-rate was 30 per cent. The water-level had been 1 ft. 6 in. below the surface in the rains of 1899, and was 10 ft. 3 in. down in February, so that in this respect the conditions were just the same as in Ward IV., so this factor will not explain the considerable difference between the health of these two Wards; the water-supply only being different. Still more marked, however, was the difference between the spleen-rates of the two northern Wards, that of Ward III., which is opposite the Mills, being 19 per cent., and that of Ward IV. immediately further north, was 54.3; in spite of the ground water-level of the latter having been 6 ft. from the surface at the height of the rains of 1899, and 18 ft. 4 in. down in February last; an exceptionally low rate. On the other hand, the number of the people examined in Ward III. who had drunk filtered water was no less than 82.5 per cent., while only 19.6 of those of the Ward I. stated that they drank filtered water, and owing to their greater distance from the supply they were probably less regular in obtaining it than were the inhabitants of Ward II. at whose doors it was placed. These figures are sufficiently striking, especially as they confirm the data obtained in several other municipalities, to be given immediately, and they are also in entire agreement with the following results of the differences in the spleen-rate among the drinkers of the different kinds of water in this Municipality. Thus among 140 filtered water drinkers, 37, or 26.4 per cent., had enlarged spleens; while among 179 river water drinkers 74, or 41.3 per cent., were similarly affected; but of 55 tank water drinkers no less than 33, or 67.2 per cent., had enlargement of this organ. Further, if we take the degree of enlargement among the different classes as detailed in Table IX, below, we find that of those who had enlarged spleens the degree of enlargement was very slight in 62 per cent. of the filtered water drinkers, in 43.2 per cent. of the river water drinkers, but only in 27 of those who drank tank water, it being considerable or very enlarged in the remainder. Not only, then, is the percentage of enlarged organs much greater in those who drank unfiltered water (the percentage of mixed river and tank water drinkers being 47.4), but the degree of

enlargement of the organ was also much more marked in the latter classes as compared with the filtered water drinkers. (See Table X.).

TABLE IX.

## TITTAGARH.

| Ward.     | Ground Water-Level. |              | Water-supply.                                       | Corrected Spleen percentages. |           |                |
|-----------|---------------------|--------------|-----------------------------------------------------|-------------------------------|-----------|----------------|
|           | Feb., 1900.         | Rains, 1899. |                                                     | Adult Males.                  | Children. | General Total. |
| IV. (24)  | 10 ft. 1 in.        | 1 ft. 3 in.  | River and Tank.                                     | 36·0                          | 60·0      | 48·0           |
| III. (25) | 10 ft. 6 in.        | 1 ft. 6 in.  | do. but $\frac{1}{3}$ of them drank filtered water. | 29·2                          | 30·8      | 30·0           |
| II. (26)  | ...                 | ...          | do. but 82% drank filtered water.                   | 19·0                          | 18·9      | 19·0           |
| I. (27)   | 18 ft. 4 in.        | 6 ft.        | River and tank water.                               | 51·3                          | 57·4      | 54·3           |

TABLE X.

## SPLEEN ENLARGEMENT AND WATER-SUPPLY IN TITTAGARH.

|                                   | Filtered water. | River water. | Tank water.  | Total. |
|-----------------------------------|-----------------|--------------|--------------|--------|
| Spleen not enlarged               | 103·0           | 105·0        | 18·0         | 226·0  |
| Spleen slightly enlarged.         | 23·0 (62%)      | 32·0 (43%)   | 10·0 (27%)   | 65·0   |
| Spleen considerably enlarged.     | 9·0 (24%)       | 26·0 (36%)   | 15·0 (40·5%) | 50·0   |
| Spleen markedly enlarged.         | 5·0 (13%)       | 16·0 (21%)   | 12·0 (32·7%) | 33·0   |
| Total examined ...                | 140             | 179          | 55           | 374    |
| Percentage with enlarged spleens. | 26·4            | 41·3         | 67·2         | 39·5%  |

NORTH BARRACKPORE.—This is a small Municipality on the east bank of the Hooghly extending from the Tittagarh Khal on the south to the Ichapur Khal on the north, and bounded on the east by the Grand Trunk Road. It consists of three circles. Firstly, Monirampur, situated in the bend of the river to the west of Barrackpore Cantonment, the spleen-rate of which is 24 per cent., while the ground water is low, there having been no water in a well 8 ft. 8 inches deep in February. The water-supply is mainly derived from the river. Secondly, Nawab-gung, also placed on the bank of the river to the north of the last



named, its spleen-rate being 28·6 per cent., while the water-level was 9 ft. below the surface of the ground in February, and had risen to 5 ft. from the ground in the rains of 1899. The water-supply is mainly derived from the river. Thirdly, Ichapur, which is situated to the north-east of the last circle, and the main portion of whose inhabitants reside at a distance of about one mile from the river, and near the Grand Trunk Road, and consequently are mainly dependant on tanks for their water-supply. The spleen-rate of this circle was 56 per cent., although as the ground water-level was 10 ft. from the surface in February and had not risen above 4 ft. in the rains of 1899 there was no difference in this respect from the other two circles which could possibly account for the greatly higher spleen-rate of Ichapur, whose water-supply from tanks instead of from the river appears to be the only possible explanation of the facts recorded.

TABLE XI.

## NORTH BARRACKPORE.

| Area.          | Ground Water-Level. |              | Water-supply. | Corrected Spleen percentages. |           |                |
|----------------|---------------------|--------------|---------------|-------------------------------|-----------|----------------|
|                | Feb., 1900.         | Rains, 1899. |               | Adult Males.                  | Children. | General Total. |
| Monirampur(28) | Below 9 ft.         | ...          | Mainly river. | 24·5                          | 23·5      | 24·0           |
| Nawabgung(29)  | 9 ft.               | 5 ft.        | do.           | 37·2                          | 30·1      | 28·6           |
| Ichapur (30)   | 10 ft.              | 4 ft.        | Tank.         | 52·0                          | 66·0      | 56·0           |

GARULIA.—This small Municipality is situated between the Hooghly river and the Grand Trunk Road immediately to the north of the Ichapur Khal, and its northern half has been supplied with filtered water from the Dunbar Cotton Mill for the past two years, but the inhabitants of the southern portion for the most part still drink river and tank water. As there was a very general opinion among the people living near the Mill that they had suffered much less from fever since the filtered water had been introduced, I determined to examine 100 persons who resided near the Mill, and the great majority of whom (about 80 per cent.) were found on inquiry to have been drinking the filtered water; and another 100 a little further to the south, but all within one mile of the former, and who stated that they drank river or tank water. Among the former class the spleen-rate was found to be 21·1 per cent., while among the river and tank water drinkers it was 46·5 per cent., although the latter included 28 men who had arrived from the North-West Provinces only in November last, that is after the fever season is nearly over, and whose spleen-rate was only 10·7 per cent. If these men are excluded from the calculation, the spleen-rate of the permanent residents of this southern portion of the

Municipality] rises to 55·5 per cent., or just over two-and-a-half times as great as among the filtered water drinkers. A well in the northern part showed a water-level 9 ft. 6 inches below the surface of the ground in February, while it had risen to within 1 ft. 6 in. during the rains of 1899, so that there must have been a considerable degree of water-logging at that time, in spite of which the spleen-rate is low. These facts appear to admit of no other explanation than that the filtered water-supply was the cause of this low rate near the Mill as compared with a precisely similar area in other respects close by which had not the advantage of the stand-pipe water.

TABLE XII.

| Area.                              | Ground Water-Level. |              | Water-supply.         | Corrected Spleen percentages. |           |                |
|------------------------------------|---------------------|--------------|-----------------------|-------------------------------|-----------|----------------|
|                                    | Feb., 1900.         | Rains, 1899. |                       | Adult Males.                  | Children. | General Total. |
|                                    |                     |              |                       |                               |           |                |
| Northern part (31)<br>(near Mill). | 9 ft. 6 in.         | 1 ft. 9 in.  | Filtered water.       | 17·7                          | 24·6      | 21·1           |
| Southern part (32)                 | ...                 | ...          | River and tank water. | 50·0                          | 61·1      | 55·5           |

BHATPARA.—This Municipality consists of a narrow strip between the river Hooghly and the Eastern Bengal Railway and to the north of Garulia, and it is divided into three Wards, the northern two, Wards I. and II., of which, more particularly, and to a somewhat less extent the southern one, Ward III., obtain some filtered water from the Mills situated within this area. The spleen-rates of all are low, that of the southern one being slightly higher than the other two, although there is not much difference in their water levels, which are slightly in favour of Ward III. The figures are given in Table XIII. below.

TABLE XIII.

| Ward.     | Ground Water-Level. |              | Water-supply.       | Corrected Spleen percentages. |           |                |
|-----------|---------------------|--------------|---------------------|-------------------------------|-----------|----------------|
|           | Feb., 1900.         | Rains, 1899. |                     | Adult Males.                  | Children. | General Total. |
|           |                     |              |                     |                               |           |                |
| III. (33) | 10 ft. 3 in.        | 4 ft. 4 in.  | Mainly river.       | 19·9                          | 27·8      | 23·6           |
| II. (34)  | 9 ft. 8 in.         | 5 ft.        | River and filtered. | 22·0                          | 12·0      | 17·0           |
| I. (35)   | 7 ft.               | 2 ft. 6 in.  | do.                 | 27·1                          | 11·5      | 19·3           |

NAIHATI.—This Municipality is situated between the Hooghly and the Eastern Bengal Railway extending from Naihati itself northwards

for five miles as far as the Bhagar Khal, and although narrow to the south it gradually widens out to the north, so that while the lower three Wards are mainly inhabited near the banks of the river, the majority of the people in the two northern Wards live at some little distance from the river at Hali-shabar and Kan-chrapara. Moreover, the Gauripur Jute Mills supply some filtered water to Ward-II., so it is worthy of note that this Ward again has the lowest spleen-rate, namely, 10·8, which is little more than half that of the Wards I. and III. on either side of it, which are dependant on the river for their supply. Further, Wards IV. and V. have the highest rates of all, being mainly dependant on tank water for their supplies, so that, and that in spite of their ground water-level being lower than that of Ward III.; so that the only way in which these variations can be explained is by the differences in the water-supplies of the various Wards, which are also in accordance with the results obtained in every previously considered instance.

TABLE XIV.

## NAIHATI.

| Ward.     | Ground Water-Level.         |              | Water-supply.    | Corrected Spleen percentages. |           |                |
|-----------|-----------------------------|--------------|------------------|-------------------------------|-----------|----------------|
|           | Feb., 1900.                 | Rains, 1899. |                  | Adult Males.                  | Children. | General Total. |
| I. (36)   | ...                         | ...          | Mainly River.    | 16·6                          | 22·5      | 19·5           |
| II. (37)  | ...                         | ...          | Partly filtered. | 6·6                           | 15·0      | 10·8           |
| III. (33) | 7 ft. 9 in.<br>16 ft. 6 in. | ...<br>8 ft. | Mainly River.    | 7·1                           | 31·0      | 19·0           |
| IV. (39)  | 10 ft. 3 in.                | 4 ft.        | Mainly Tank.     | 15·3                          | 29·4      | 22·3           |
| V. (40)   | 10 ft. 3 in.                | 4 ft.        | Tank.            | 13·3                          | 42·5      | 27·9           |

BARASET.—This Municipality is situated on the Soonthee Nudi some eight miles east of the Hooghly river, and its surface drainage flows away to the south-east into the Kocho Bhil. The Soonthee was formerly a large river, but now it resembles an elongated swamp with little or no current except during the rainy season, while its bed is encroached upon in numerous places by series of tanks which in places leave but a few yards between them for the stream, and fishing weirs, etc., also obstruct its course. The Municipality is divided into five Wards, Nos. I. and II. including the town, while Nos. IV. and V. are to the east on the Soonthee Khal, and No. III. to the south. In all the spleen-rates are high, and the ground water-levels do not vary much, but are high in the rains, showing obstructed drainage and water-logging. The water-supply is from tanks, although one or two tube wells have been put down

TABLE XV.

## BARASSET.

| Ward.          | Ground Water-Level. |              | Water-supply. | Corrected Spleen percentages. |           |                |
|----------------|---------------------|--------------|---------------|-------------------------------|-----------|----------------|
|                | Feb., 1900.         | Rains, 1899. |               | Adult Males.                  | Children. | General Total. |
| I. & III. (41) | 12 ft. 4 in.        |              | Tank only     | 52·3                          | 50·4      | 51·5           |
| III. (42)      | 16 ft. 3 in.        | 4 ft.        | do.           | 38·1                          | 80·3      | 59·2           |
| IV. (43)       | 8 ft. 2 in.         | 0 ft. 3 in.  | do.           | 44·2                          | 70·8      | 57·5           |
| V. (44)        | 12 ft. 4 in.        | 4 ft.        | do.           | 38·6                          | 51·2      | 44·9           |

WATER-LOGGING AND THE RAILWAY.—It has already been pointed out in discussing the Ward variations of the spleen-rate that there is no definite relationship between the amount of malaria and the ground water-levels. Thus Maniktolla and Chitpore-Cossipore are the most water-logged parts of the whole area, yet they have the lowest spleen-rates on account of their filtered water-supply. The fact that the bank of the Hooghly river is slightly higher than the country further to the east, so that the surface water flows away from the river, and eventually finds its way back through khals to the river or runs off to the south into the Great Salt Water Lakes, might at first sight seem to indicate that the ground water-level would be lower near the river than it is further to the east. Measurements in the wells, however, do not bear this out, for there is very little difference in this respect in the water-level measured in wells on either side of the railway, while the differences noted were rather more frequently in favour of the eastern portions than the contrary. The differences in the spleen-rate, then, of the eastern and western parts cannot be explained on any theory of water-logging, while an examination of the whole area Ward by Ward shows no definite relationship between the spleen-rates and the height of the ground water-level, as a study of the Tables and Map will show.

The Eastern Bengal Railway, which runs from north to south through this area, and, together with the Grand Trunk Road, roughly divides it into western and eastern portions, has frequently been held responsible for the unhealthiness of the country, for it lies across the line of surface drainage. As, however, the drainage flows to the east if it were materially obstructed the western part should be the more unhealthy, instead of which precisely the opposite holds good. Moreover, in the few places in which wells were found on either side of the railway, although at some distance from it, there was no constant or marked difference between either the level of the ground-water in the dry season, or the height to which it rose during the rains on either side of the road and railway. There is, then, no

evidence that the health of this tract has been influenced by the railway or the Grand Trunk Road, and the spleen variations cannot possibly be attributed to their action.

#### DISTRIBUTION OF THE *Anopheles Mosquitos*.

It must now be taken as proved that malaria can be communicated to man by the bites of the *Anopheles* genus of mosquitos, which have previously bitten another case of malaria, and in whose body the plasmodium has undergone developemental changes. It still, however, remains to be proved that this is the only or even the most common way in which the disease is obtained, and it is worthy of note that Laveran, who was the first modern exponent of the mosquito theory, is still of the opinion that it will not explain all that is known of the etiology of the disease. Still enough is known to make it highly advisable to consider the question of the possibility of destroying the particular breed of mosquito which plays a part in distributing malaria. This should not be impossible in limited areas, at any rate, if Major Ross's statement as to their breeding-grounds is correct, namely, that they mainly breed in small pools which are not inhabited by fish, and yet are not so small that they will dry up in a few days, and consequently that such suitable pools are few and far between. In order to test this statement I searched for the larvæ in several Municipalities, but regret to say that I have not been able to confirm Ross's statements. On the contrary, I found the *Anopheles* larvæ in numerous tanks as well as in the small pools which Ross describes, and that too in spite of the former as well as some of the latter abounding in fish. This having been ascertained, a small portion of Maniktolla, measuring about one-sixteenth of a square mile, and containing some thirty tanks, was further examined. During the dry months of from February to May, which are the minimum fever months of the year, I found the *Anopheles* larvæ in from one-third to two-thirds of these tanks, often in enormous numbers, one of them for example, having been estimated to have contained several million larvæ on one day on which it was examined in May. In the earlier months especially they were also found in several small pools, but the numbers there were nothing as compared to those in the tanks, which are certainly the common breeding-ground of the *Anopheles* in the dry season at any rate. Three pools in a low-lying area are of interest, for in one, some two yards square, and a second which was five yards in diameter, fairly numerous *Anopheles* larvæ were found in spite of the presence of small fish in both, so that it is not surprising that they can also survive in tanks which are swarming with fish. Further, I failed to find any cases of fever near the infected tanks in the hot weather. As

there must be several hundred tanks in the five square miles of Manik-tolla alone, the chances of being able to destroy these larvæ appears to be very remote. Further observations are being made on the seasonal distribution of these larvæ and the amount of fever, but it may be mentioned that they nearly disappeared from the tanks after the first burst of the rains, and remained absent during a break which followed, although fever now began to be prevalent, so that up to the present the number of the *Anopheles* has been in inverse proportion to the amount of fever. Possibly the tank forms are different from those of the rainy season in the small pools, but I have not yet been able to settle this point. The differences will be only microscopical, so that this would not lessen the practical difficulties in lessening malaria in Bengal by destroying the mosquitos, the only possible way of partially affecting which would appear to lie in the time-honoured method of extensive drainage in order to lessen the number of suitable breeding-grounds for the mosquitos.

The great difficulty of destroying the *Anopheles* larvæ in Bengal enhances the importance of the influence of a filtered water-supply in reducing so materially the amount of fever, which has been shown to be the case in portions of this tract of country, while the much greater liability of the drinkers of tank water to malaria suggests that the disease may commonly be obtained by drinking infected water, as has for centuries been considered to be the case. Such a mode of infection may be easily reconciled with the mosquito theory if we allow that these insects, in addition to directly inoculating the disease, may also take the parasite back to water, perhaps by means of the black spores described by Ross, in which they may survive for a limited time only, so that the infection has frequently to be renewed by the mosquitos. This is a point which can only be settled by investigation, which I hope shortly to be able to undertake.

Lastly, an examination of charts showing the monthly rainfall and fever-rate in this tract of country revealed the fact there is no constant relationship between either the amount or monthly distribution of the rainfall of different years and the amount of malarial fever. A more detailed examination, however, showed that there is a relationship between the daily distribution of the rain and the fever; those years in which the rainfall is very irregularly distributed with frequent and prolonged breaks, being those in which malarial fevers are most prevalent. This point is also being more closely studied, in conjunction with the observations on the variations in the distribution of the *Anopheles*.

## CONCLUSIONS.

The general result of the inquiry has been to show that there is a marked difference between the health of the riverine and more inland portions of the area examined, the former being much more healthy than the latter. The comparatively healthy area extends from the river to the Grand Trunk Road, and in some parts to the Railway, a distance varying from one to two miles. No marked or constant differences in the ground water-level of the healthy and unhealthy parts has been found, which could possibly account for the differences in the spleen-rate noted, so that no theory of water-logging will explain them.

The most striking exception to the rule that the areas at a distance from the river bank have a high spleen-rate is that of Maniktolla, and the eastern portions of Chitpore-Cossipore between the Grand Trunk Road and the railway, both of which, together with the rest of the latter Municipality, have the lowest spleen-rates of all. Moreover they are also the most water-logged portions of the whole area, their ground water-levels both in the dry and in the rainy seasons being the highest met with, so that there must be some other factor to account for their marked immunity from malaria. This is certainly not the absence of the malaria-bearing mosquito, for it was in the first-named place that they were found to be more wide-spread during the minimum fever season than has hitherto been reported from any part of India. The only possible factor remaining is the water-supply, and it is noteworthy that these two water-logged Municipalities are the only ones which have a full filtered water-supply from the same source as Calcutta itself. That this good water-supply is the true explanation of their relative immunity from malaria is borne out by the very low spleen-rate of certain Wards of other Municipalities which have a partial filtered water-supply from various Mills, together with the low rates of the Wards of Baranagar and South Dum Dum, which border on Chitpore-Cossipore, from whose stand-pipes some of their inhabitants were obtaining filtered water, the details of which have already been given. Finally, the figures given in Table X. shows the spleen-rates among river water drinkers to be nearly double, and that of tank water drinkers to be nearly treble that of filtered water drinkers, strongly corroborate the evidence as to the benefit to be derived from filtered water, and affords a key to the whole distribution of the varying spleen-rates, as can be seen from a study of the accompanying map. Thus, Chitpore-Cossipore West, which has the double advantage of a filtered water-supply and close proximity to the river, so that those who do not drink filtered water will for the most part take river water, has the lowest rate of all, namely, 7.4. The eastern part of the same Municipality, which

has tank instead of river water as an alternative to the filtered supply, on the other hand, has a spleen-rate of 14·8, which is almost the same figure as that of Maniktolla, with a similar water-supply. Further, those Wards which are situated immediately on the river bank, but do not possess a filtered water-supply, and consequently get their supply mainly from the river, and to a less extent from tanks, have a rate intermediate between those with filtered water and the inland ones which are dependant entirely on tank water. In short, all the Ward variations in the spleen-rate of the whole area can be explained on the ground of their varying water-supplies in a manner which no other explanation will approach in completeness, so that it is impossible to come to any other conclusion than that the above is the true explanation of the facts recorded. Whether the *Anopheles* mosquitos play a part by taking the malarial parasite back to the tanks from their human hosts or not must be left to be determined by future experiments, but that a good water-supply is an important prophylactic measure in the lessening the prevalence of malaria must I think be admitted, and can be safely acted on.

XVIII.—I. *Further Researches on Mercurous Nitrite and its Derivalives.*

II. *On Mercurous Iodide and a new Method of its Preparation.*—By

P. C. RAY, D.Sc.

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- II. Mercurous Iodide: a new Method of its Preparation.

(1)

PREPARATION OF MERCUROUS NITRITE ON A LARGE SCALE.

As the investigations I am about to describe involve the use of comparatively large quantities of mercurous nitrite at a time I shall



begin with describing a method of preparing the salt, which has been found to be more economical and far less troublesome than the usual method.

A tall beaker is taken containing nitric acid (sp. gr. 1041) diluted in the proportion of 1 : 4 with water; mercury is now poured in, care being taken not to fully cover the bottom but to leave an annular or horse-shoe-shaped space. The crystals which are formed on the convex surface of the mercury are continually pushed aside into the empty space by the evolution of gases during the initial stages of the reaction. On standing overnight, however, a crust of the nitrite is formed on the surface of the metal, which acts as a protective layer, thereby hindering further action.

All that is now necessary to do is to incline the beaker gently, when the deposit of the salt slips off into the empty space as explained before, leaving a fresh surface of mercury exposed. This may be repeated 4 or 5 times in the course of the day. Instead of inclining the beaker, the layer of crystals may be carefully scraped off the surface with a glass rod. The process may be allowed to go on for a week, resulting in the continuous growth and accumulation of the salt; the reaction may be started simultaneously in about half a dozen beakers arranged in a row, so as to secure a copious supply.

In the previous papers\* it was recommended that each time a layer of crystals is formed, the mother liquor together with the mercury should be decanted off into another beaker. This is a wasteful method, for as soon as the super-incumbent liquid is removed, torrents of red fumes appear on the surface of the mercury. These red fumes are caused by the combination of nitric oxide with the oxygen of the air. It is the nitric oxide that evidently gives rise to the formation of the nitrite, and its loss has to be guarded against.

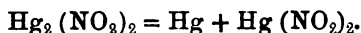
(2)

PREPARATION OF CHEMICALLY PURE MERCUROUS NITRITE.

The mercurous nitrite prepared as above will answer well enough for ordinary purposes. It generally contains, however, impurities, chiefly in two shapes. First, the crystalline mass encloses minute globules of mercury which cannot be entirely detached. Secondly, as the salt has to be dried on the porous tile, a portion of the heavy mother liquor consisting of mercurous *nitrate* dries up along with it. When it is desirable to obtain the salt in a state of absolute purity, it is mixed with a sufficiently large quantity of water and heated to boiling point for some

\* For literature on the subject, see *Journal, Asiatic Society*, 1896, Pt. ii, p. 1, and *Transactions, Chem. Soc.* for 1897, p. 338.

time. Treated in this way about 18 p.c. of the nitrite undergoes dissociation as already pointed out; thus:



While by far the larger proportion of it dissolves *as such*; the saturated solution while still hot is rapidly passed through a "ribbed" filter paper, and the filtrate briskly stirred with a rod. In this way a fine, mealy, crystalline deposit is obtained, which is dried on a porous tile and preserved *inside a dessicator*. The presence of even a trace of atmospheric moisture brings about slow decomposition evolving nitrous fumes. As a test case it may be mentioned that 0.54 g. of the pure salt was placed on the scale pan for three hours, and it lost 5 mgs. during that time.

## (3)

## INTERACTION OF MERCUROUS NITRITE AND ETHYL IODIDE.

*Preliminary.*

About four years ago while describing mercurous nitrite and its general properties, which were found to bear a remarkable analogy to those of silver nitrite, the author expressed a hope that this new compound would yield nitro ethane by interaction with ethyl iodide.

Since then it has been qualitatively shown that the reaction gives simultaneously both nitro ethane and its isomer, ethyl nitrite.\* The present investigation embodies a fuller and more systematic study of this reaction.

*Experimental.*

The general method first described by V. Meyer and O. Stüber has been in the main followed.† I shall therefore confine myself to such details only as have a direct bearing on the subject in hand.

Exp. I. 120 g. of mercurous nitrite and 69 g. of ethyl iodide were digested together over a water bath in a round-bottomed flask to which was attached a tubulated funnel and a reflex condenser. The digestion was continued so long as ethyl nitrite was evolved. It is necessary to note here that as soon as ethyl iodide is poured on silver nitrite, an energetic action at once sets in, but when mercurous nitrite is added to the alkyl iodide there is scarcely any perceptible evolution of heat, and the reaction only begins after digestion has proceeded for some time. The open

\* Proc. Chem. Soc. 1896, p. 218.

† Ber. Deut. Chem. Ges., V, pp. 399, 514.

end of the condenser was connected with two tall cylinders (See Fig.)

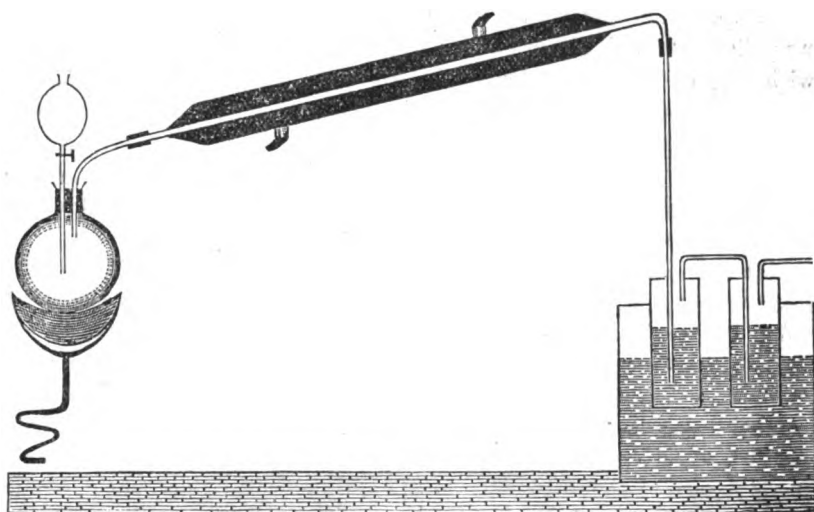


Fig. shewing the formation of Ethyl Nitrite and its absorption by Alcohol.

containing a measured volume of alcohol for the absorption of ethyl nitrite. These cylinders were again kept immersed in ice-cooled water of an average temperature of  $10^{\circ}$  C., that of the Laboratory varying from  $23^{\circ}$  to  $25^{\circ}$  C. In this manner a concentrated solution of what is called in the Pharmacopœia *Spiritus Ætheris Nitrosi*, was obtained, the strength of which was determined by Allen's method.\* The yield of ethyl nitrite was found to be 5.1 g.

Exp. II. 94 g. of mercurous nitrite and 35 gms. of ethyl iodide were digested as above. The yield of ethyl nitrite was 3.1 g.

Exp. III. In this case 138 g. of mercurous nitrite were digested with 54 g. of ethyl iodide, yielding 5.2 g. of ethyl nitrite.

It will thus be seen that the yield of ethyl nitrite is only a fraction of what is demanded by theory. This is partly due to the reaction being completed only during subsequent digestion on the oil bath, but chiefly to the fact that when once a certain amount of mercurous iodide has been superficially formed, a large proportion of the nitrite aggregates into hard lumps into which the ethyl iodide can only slowly and with difficulty penetrate.

\* *Pharmaceutical Journal*, 3rd Series, Vol. XV, p. 673.

This is also the case with silver nitrite, though not in so marked a degree.\*

Exp. IV. This was a control experiment in which silver nitrite was digested with ethyl iodide: 90 g. of the silver salt were treated with 88 g. of the alkyl haloid. The yield of ethyl nitrite was 4.2 g.

#### NITRO ETHANE.

After the evolution of ethyl nitrite had ceased, the contents of the flask were subjected to distillation, first over a water bath, and afterwards over an oil bath. The distillates were caught separately.

It was invariably found that during distillation over an oil bath, the receiver was filled with nitrous fumes, a part of which was absorbed by the distillate, imparting to it a bluish tinge. As there was not the slightest trace of yellow colour either in the flask or in the condenser itself, it was suspected that *nitric oxide* was evolved by the slow and gradual decomposition of a portion of mercurous nitrite, which combined with the oxygen of the air in the receiver. The suspicion was confirmed. The presence of the nitrous fumes is highly objectionable, as the crude nitro ethane so obstinately holds them in solution that they cannot be got rid of during fractionation. Distillation in a slow current of carbon dioxide was therefore resorted to for excluding air. In the control experiment with silver nitrite (See *ante*, Exp. IV.) nitrous fumes, though in a far lesser degree, were also noticed in the receiver.†

After the distillation was over, the compact mass of mercurous iodide and nitrite were removed from the flask, well powdered in a mortar, and once more treated with the fraction below 100°, when a further quantity of crude nitro ethane was obtained.

A fair idea of the yield of nitro ethane may be had from the details of one among several experiments. 190 g. of mercurous nitrite and 95 g. of ethyl iodide yielded a distillate of 7 g. between 100°–108°, of 3½ g. between 108°–110°, and of 4 g. between 111°–114°.

The fraction which came off between 113°·5'–114° (uncorrected) was practically pure nitro ethane. It was treated with an alcoholic solution of caustic soda as recommended by Nef. (*Annalen*: 280, p. 267). The

\* "Es gelang uns unter keinen Umständen das ganze Jodäthyl in die Reaction zu verwickeln, sondern stets war das bei der Rectification zuerst übergehende Produkt stark jodhaltig. Wir haben auf jede weise versucht, das Jodäthyl voll ständig auszubenten, doch immer vergeblich." (*Loc. cit.*, p. 402.)

† The behaviour of Mercurous Nitrite in this respect also resembles that of Silver Nitrite. Cf. Divers and Schmidzu "Action of heat upon Silver Nitrite, air being excluded"—(*Trans. Chem. Soc. Journ.*, 47, 634), where it is shown that nitric oxide is one of the products of decomposition.

precipitate of sodium nitro-ethane was washed with absolute alcohol. In this manner 2.5 g. of nitro-ethane yielded 2.1 g. of the sodium compound.

It responded to all the characteristic reactions: its aqueous solution turned blood-red with ferric chloride and green with copper sulphate. A concentrated solution of it gave with corrosive sublimate solution a white, mealy, crystalline precipitate. The sodium salt which is extremely hygroscopic exploded with a loud detonation when heated in a narrow test tube. An estimation of sodium is given below.

|    |                                                               |
|----|---------------------------------------------------------------|
|    | 0.2416 g. gave 0.1795 g. of Na <sub>2</sub> SO <sub>4</sub> . |
|    | Calc. for                      Found.                         |
|    | Na C <sub>2</sub> H <sub>4</sub> NO <sub>2</sub> 24.06.       |
| Na | 23, 60                                                        |

From the above investigations it would appear that by the action of mercurous nitrite on ethyl iodide about equal quantities of nitro ethane and its isomer ethyl nitrite are formed. The yield is, however, somewhat poorer than with silver nitrite, owing to the formation of very compact, hard lumps of mercurous iodide, which interferes with the reaction being completed.

## (4)

INTERACTION OF MERCUROUS AND MERCURIC NITRITES WITH THE NITRITES OF SILVER AND SODIUM.

## I.

*Mercuric Nitrite and Sodium Nitrite.*

To the neutral solution of mercurous and mercuric nitrites (the products of dissociation of mercurous nitrite: Journ. Chem. Soc. Trans. 1897, p. 340) is added sodium chloride to remove mercurous mercury. The filtrate which now contains mercuric nitrite and a small quantity of sodium chloride if it was added in excess, as well as *sodium nitrite*, is allowed to evaporate spontaneously. In course of time an orange, crystalline deposit is formed, and this is followed by the appearance of shining iodine-like dark scales; and last of all we obtain a yield of rhombohedral crystals of *sodium nitrate*. Sometimes the orange-red and black compounds are not obtained, but instead we get only sodium nitrate, sometimes again the three compounds are obtained in regular succession, though one kind may predominate over the others.

During the last three years I have repeated the experiments several times, but I have not been able so to control them as to ensure the formation of one variety only to the exclusion of the others.

If there be no sodium chloride present in the mercuric solution, the red and black deposits are not formed, for, as will be seen below,

they are oxychlorides of mercury and the presence of sodium chloride is a *sine quâ non* for their formation, and the only yield is one of sodium nitrate. But this last compound has sometimes been observed as the sole product without the formation of the former, even in presence of an excess of sodium chloride. The reaction goes on very slowly, and it takes a month and upwards to complete it.

Analysis and general properties of the red and iodine-like lustrous scales:—

- (1) 0.3505 g. gave 0.3485 HgS.  
 (2) 0.465 „ „ 0.455 „  
 (3) 0.5086 „ „ 0.2034 AgCl.  
 (4) 0.6166 „ „ 21.1 c.c. moist O at 31° C. and 752 mm.  
 pressure.

|                  | Theory for                 | Theory for                                                 | Found |       |
|------------------|----------------------------|------------------------------------------------------------|-------|-------|
|                  | Hg Cl <sub>2</sub> . 2 HgO | Hg Cl <sub>2</sub> . 2 HgO. $\frac{1}{2}$ H <sub>2</sub> O | i     | ii    |
| Hg               | 85.35                      | 84.27                                                      | 84.45 | 84.34 |
| Cl               | 10.10                      | 9.97                                                       | 9.90  |       |
| O                | 4.55                       | 4.50                                                       | 4.17  |       |
| H <sub>2</sub> O |                            | 1.26                                                       |       |       |
|                  | 100.00                     | 100.00                                                     |       |       |

The analyses recorded above are of distinct preparations, and they conform to the formula HgCl<sub>2</sub>. 2 HgO.  $\frac{1}{2}$  H<sub>2</sub>O.

These salts do not lose in weight when kept in a desiccator over strong sulphuric acid or placed in a steam chamber at 100° C. When heated in a bulb-tube a deposit of moisture is invariably noticed, and a sublimate of mercurous and mercuric chloride obtained, with a residue of orange-yellow oxide. Treated with caustic soda solution, the dark variety changes to orange-yellow.

Millon, and more recently Thummel (Archiv. Pharm.§ [3], 27, 589-605) have exhaustively studied the oxychlorides of mercury, and have described several of them. These were obtained, however, by adding together solutions of mercuric chloride and hydrogen potassium carbonate under varying conditions. Volhard got shining dark crystals by the action of sodium acetate upon corrosive sublimate solution (Annalen : 255, p. 252) ; whilst Haack obtained a reddish-brown crystalline deposit by treating mercuric chloride with phosphate of sodium (*ibid.* 262, 189), all of the formula HgCl<sub>2</sub>. 2 HgO. The red and black shining compounds, the subject of the present paper, agree in general

§ The Original Memoir is not available here. I am quoting from Watt's Dict. of Chem., New Ed. See also Abs. Chem. Soc. Journ., Vol. LVI, 1050.

properties with those obtained by the above chemists; but the *hydrated* modifications I do not find mentioned anywhere.

## I.

*Mercurous Nitrite and Silver Nitrite.*

A. Concentrated solutions of mercurous nitrite and silver nitrite.

As both mercurous nitrite and silver nitrite are very sparingly soluble in cold water, the solutions used were always kept at about 100° C.

*Method of experiment* :—To the hot or boiling solution of mercurous nitrite containing necessarily mercuric nitrite was added the solution of silver nitrite. No effervescence due to the evolution of gases was noticed, and the liquid which at once became cloudy on account of the separation of metallic mercury, was allowed to stand over night. Next day a perfectly clear solution was obtained, with a deposit of mercury and silver in successive layers at the bottom of the vessel,—the lower one of dirty grey mercury, and the upper one of an arborescent and filamentous growth of shining minute crystals of silver. These metals were estimated in the usual way. The strength of the filtrate was determined by finding out the weights of the *ous* and *ic* mercury as well as that of silver in solution. Control analyses were also simultaneously made to ascertain the original strengths of the mercury and silver nitrite solutions under exactly similar conditions of temperature. For details see Table of Analyses.

In order to estimate the total amount of nitrogen and the transformation, if any, of the nitrite into nitrate, or any other compound of nitrogen, the following method of analysis as exemplified in Exp. I was adopted.

50 c.c. of mercurous and mercuric nitrite solution were boiled for a few minutes with an excess of caustic soda; 25 c.c. of silver nitrite solution were also similarly treated. The filtrates from the mercury and silver precipitates, containing nitrogen in the shape of nitrite of sodium, were now added together and made up to a given volume. After the interaction of mercurous and silver nitrite solution, an aliquot portion of it was boiled with the alkali, and the filtrate set aside as above. The nitrogen in both the cases was estimated by the Crum-Frankland process, as also by the *Urea* method as worked out by Percy Frankland. As a further check a few c.c.'s were in certain instances evaporated to dryness in a porcelain boat and the nitrogen determined by Dumas' method. It is remarkable that the sum total of nitrogen as found by all these different methods was exactly the same, proving that *not only was there no loss of nitrogen during the reaction but that it remained all*

along in the shape of the nitrites of the respective metals, in other words, there was no change in the radical  $\text{NO}_2$ .

B. Dilute solutions of silver and mercurous nitrite, (*vide* Exp. 5 and 6 in the Table of Results of Analyses).

It is worthy of note that under such conditions of dilution no silver was precipitated.

### C. Mercurous Nitrite and Sodium Nitrite.

In this case also the total amount of nitrogen remained constant, and in the shape of nitrites, the only difference being that the mercurous nitrite was completely transformed into mercuric nitrite with precipitation of mercury. In Exp. 7 a 6% solution of sodium nitrite was used. Sodium nitrite was, however, found to have scarcely any action on very dilute solutions of mercurous nitrite.

### DISCUSSION OF RESULTS.

It is not easy to enter into the mechanism of the reaction of mercurous and silver nitrites, when it is remembered that there is no change in the radical  $\text{NO}_2$ . Mercurous nitrite, it is true, has already been shown to undergo partial dissociation according to the equation,



when in solution; but the reaction, we are at present studying, can scarcely be brought under the same category. At the same time, it must be admitted that, if we were to regard for a moment a molecule of silver nitrite playing the role of a molecule of mercurous nitrite, all the equations under A. could be established on a common basis.

For instance in Exp. 1,  $3 \text{ Hg NO}_2 + \text{Ag NO}_2$  may be regarded as equivalent to  $4 \text{ Hg NO}_2$ , *i.e.*,  $2 \text{ Hg}_2 (\text{NO}_2)_2$  which may be expected to dissociate as follows:—

$2 \text{ Hg}_2 (\text{NO}_2)_2 = 2 \text{ Hg} (\text{NO}_2)_2 + 2 \text{ Hg}$  [or  $\text{Hg} + \text{Ag}$ ]. In Exp. 3,  $7 \text{ Hg NO}_2 + 3 \text{ Ag NO}_2$  would similarly be equivalent to  $10 \text{ Hg NO}_2$ , *i.e.*,  $5 \text{ Hg}_2 (\text{NO}_2)_2$  which would dissociate thus:  $5 \text{ Hg}_2 (\text{NO}_2)_2 = 5 \text{ Hg} (\text{NO}_2)_2 + 5 \text{ Hg}$  [or  $2 \text{ Hg} + 3 \text{ Ag}$ ], with this difference, that in place of  $2 \text{ Hg}$  we get  $\text{Hg} + \text{Ag}$ , and in that of  $5 \text{ Hg}$  we get  $2 \text{ Hg} + 3 \text{ Ag}$ . In Exp. 5 and 6 bracketted together under B., where dilute solutions of both the nitrites were used, and where there was no precipitate of metallic silver, the nitrite of silver apparently seems to take no part. The same remarks would also apply to Exp. 7 and 8 (*vide* Table of Analyses), where sodium nitrite also appear to act *catalytically*, an expression conveniently used to cover ignorance. The true explanation of the reaction has yet to be found out, and with this view, it is intended to take up another series of experiments under various degrees of dilution of the nitrites.



Table of Results of Analyses.

| No of Exp. | O. O. of Mercury | Wt. of Mercury in Sol. in grams. | Wt. of, <i>tc</i> , Mer-cury in Sol. | O. O. of AgNO <sub>3</sub>                   | Wt. of Ag in Sol.                   | Wt. of <i>ous</i> Mer-cury after addition of AgNO <sub>3</sub> Sol. | Wt. of, <i>tc</i> , Mer-cury in ditto. | Wt. of "free," <i>tc</i> , pptd. Mer-cury. | Wt. of "free" Silver. | Reaction as Expressed in Formula.                                                                                                                                                                                                                    |
|------------|------------------|----------------------------------|--------------------------------------|----------------------------------------------|-------------------------------------|---------------------------------------------------------------------|----------------------------------------|--------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1)        | 50               | 1.074                            | 0.868                                | 25                                           | 0.304                               | 0.564                                                               | 1.205                                  | 0.168                                      | 0.104                 | $\left\{ \begin{array}{l} 6 \text{ Hg NO}_2 + 5 \text{ Hg}' (\text{NO}_2)_2 + 3 \text{ Ag} \\ \text{NO}_2 = 3 \text{ Hg}' \text{NO}_2 + 7 \text{ Hg}' (\text{NO}_2)_2 \\ + 2 \text{ AgNO}_3 + \text{Hg} + \text{Ag.} \end{array} \right\}$           |
|            | 50               | 0.685                            | 0.676                                | 25                                           | 0.238                               | 0.257                                                               | 0.973                                  | 0.180                                      | 0.117                 | $\left\{ \begin{array}{l} 5 \text{ Hg}' \text{NO}_2 + 5 \text{ Hg}' (\text{NO}_2)_2 + 2 \text{ Ag} \\ \text{NO}_2 = 2 \text{ Hg}' \text{NO}_2 + 7 \text{ Hg}' (\text{NO}_2)_2 \\ + \text{Ag NO}_3 + \text{Hg} + \text{Ag.} \end{array} \right\}$     |
| (3)        | 25               | 0.173                            | 0.188                                | 20                                           | 0.063                               | 0.053                                                               | 0.274                                  | 0.084                                      | 0.027                 | $\left\{ \begin{array}{l} 10 \text{ Hg}' \text{NO}_2 + 11 \text{ Hg}' (\text{NO}_2)_2 + 7 \\ \text{Ag NO}_2 = 3 \text{ Hg}' \text{NO}_2 + 16 \text{ Hg}' \\ (\text{NO}_2)_2 + 4 \text{ Ag NO}_2 + 2 \text{ Hg} + 3 \text{ Ag.} \end{array} \right\}$ |
|            | 100              | 0.564                            | 0.569                                | 50                                           | 0.0523                              | 0.488                                                               | 0.614                                  | 0.031                                      | 0.0105                | $\left\{ \begin{array}{l} 18 \text{ Hg}' \text{NO}_2 + 18 \text{ Hg}' (\text{NO}_2)_2 + 5 \\ \text{Ag NO}_2 = 15 \text{ Hg}' \text{NO}_2 + 20 \text{ Hg}' \\ (\text{NO}_2)_2 + 4 \text{ Ag NO}_2 + \text{Hg} + \text{Ag.} \end{array} \right\}$      |
| (5)        | 100              | 0.3454                           | 0.382                                | 50                                           | 0.076                               | 0.2284                                                              | 0.4464                                 | 0.087                                      | ...                   | $\left\{ \begin{array}{l} 6 \text{ Hg}' \text{NO}_2 + 7 \text{ Hg}' (\text{NO}_2)_2 + \text{Ag NO}_2 \\ = 4 \text{ Hg}' \text{NO}_2 + 8 \text{ Hg}' (\text{NO}_2)_2 + \\ \text{AgNO}_3 + \text{Hg.} \end{array} \right\}$                            |
|            | 100              | 0.392                            | 0.486                                | 50                                           | 0.042                               | 0.345                                                               | 0.507                                  | 0.026                                      | ...                   | $\left\{ \begin{array}{l} 15 \text{ Hg}' \text{NO}_2 + 19 \text{ Hg}' (\text{NO}_2)_2 + \text{Ag} \\ \text{NO}_2 = 13 \text{ Hg}' \text{NO}_2 + 20 \text{ Hg}' (\text{NO}_2)_2 \\ + \text{AgNO}_3 + \text{Hg.} \end{array} \right\}$                 |
| (7)        | 25               | 0.172                            | 0.242                                | Na<br>No <sub>3</sub> in<br>o. 20<br>in Sol. | Wt. of<br>NaNo <sub>3</sub><br>1.20 | ...                                                                 | 0.333                                  | 0.081                                      | ...                   | $\left\{ \begin{array}{l} 2 \text{ Hg}' \text{NO}_2 + 3 \text{ Hg}' (\text{NO}_2)_2 + \text{Na} \\ \text{NO}_2 = \text{Hg}' (\text{NO}_2)_2 + \\ \text{NaNO}_3 + \text{Hg.} \end{array} \right\}$                                                    |
|            | 25               | 0.700                            | 0.620                                | 20                                           | ...                                 | ...                                                                 | 0.980                                  | 0.34                                       | ...                   | $\left\{ \begin{array}{l} 2 \text{ Hg}' \text{NO}_2 + 2 \text{ Hg}' (\text{NO}_2)_2 + \text{Na} \\ \text{NO}_2 = \text{Hg}' (\text{NO}_2)_2 + \text{Hg.} \\ \text{Na}_2 \text{NO}_2 + \text{Hg.} \end{array} \right\}$                               |

CHEMICAL LABORATORY, Presidency College.

ON MERCUROUS IODIDE—*A new Method of its Preparation.*

The yellow residue in the flask (see previous paper) consisting presumably of a mixture of mercurous iodide and the unacted-upon mercurous nitrite was well powdered and introduced into a combustion tube, plugged with asbestos and heated in a tube-heater (Röhren-Oefen.). The powder occupied nearly one-third the length of the tube. When the temperature rose to about 135° C, nitrous fumes began to be disengaged, and an oily liquid collected at the mouth of the tube. This liquid is nitro-ethane, a portion of which obstinately remains absorbed in the hard mass of the mixture referred to above.

On heating more than two hours from 155° to 163°, for the most part stationary at the latter temperature, a thin deposit of lustrous lemon-yellow scales was obtained. The yield however was very poor. Next day the heat was raised to 192°, and the temperature maintained nearly constant for three hours: a sublimate of a compact mass of yellow and orange-yellow crystals was the result.

In another experiment the sublimation was carried on between 190°-210° C. stationary for the most part at 210°, in this case orange-yellow crystals were obtained. In several experiments, however, conducted within the above range of temperatures, the sublimate which was deposited nearest the source of heat was of a dark brown tint; next to it was a deposit of orange-yellow and yellow tablets respectively; and, last of all, near the mouth of the tube was a ring of scarlet crystals of *mercuric* iodide. Sometimes it so happened that by far the larger proportion of the sublimate was of scarlet *mercuric* iodide; but whether this was due to the decomposition or dissociation of mercurous iodide formed at first ( $\text{Hg}_2\text{I}_2 = \text{HgI}_2 + \text{Hg}$ ) or not is not clear. More than a dozen experiments were carried on, and the experiences accruing therefrom are recorded above.

*General properties*:—In Yvon's\* experiment in which Mercurous Iodide was prepared by the direct union of the elements, only the yellow and orange-yellow crystals are described. According to this chemist sublimation begins at 190° C. My own experience confirms his in the main, though I have noticed that a small quantity of mercurous iodide almost always sublimes between 163° and 170° C.

The dark brown variety when powdered and kept in contact with dilute nitric acid turns dirty yellow, and the orange-yellow under similar conditions orange-red, without undergoing change in the composition; but boiled for some time with the dilute acid, both these varieties are gradually transformed into *mercuric* iodide, and from the

\* Compt. Rend. 76, p. 1607.

hot mother liquor also bright scarlet spangles of mercuric iodide crystallize out on cooling.

*Result of Analysis*:—Estimation of iodine. The methods described in the standard works of Fresenius, Crookes, &c., for the estimation of iodine in mercurous iodide appeared to be tedious and troublesome in view of the numerous determinations involved. Reduction was effected with zinc and sulphuric acid under certain modifications. The compound is finely powdered and transferred to a flask. Pure granulated zinc and dilute sulphuric acid are then added together with a few pieces of scrap platinum, when evolution of hydrogen at once sets up; the flask is kept actively rotated. After a few minutes the zinc becomes amalgamated and further action ceases. A drop of platonic chloride is now added, reduction proceeds, and a pink colour pervades the liquid, and the flask is shaken as before. When the reduction is complete the solution should be perfectly clear and colourless, and there should not be any trace of a powdery black residue at the bottom of the flask. The iodine is estimated in the usual way, and the additional halogen introduced with the standard  $\text{Pt.Cl}_4$  drop, corresponding in the present instances to  $0.005 \text{ AgCl}$ , allowed for. Sometimes the zinc is treated beforehand with the dilute acid and a few drops of  $\text{PtCl}_4$ , and the *platinized* zinc, washed free from chlorine, is added in successive instalments to bring about reduction, which is finished in 20 min. to half an hour.

As control experiments, iodine in resublimed mercuric iodide was estimated according to the above method. Thus:

|       |                          |      |                                                                                                                                                                                                                                                                                                                   |   |    |       |       |
|-------|--------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-------|-------|
|       | (1) 0.2232 g.            | gave | 0.2324 AgI                                                                                                                                                                                                                                                                                                        |   |    |       |       |
|       | (2) 0.0604 "             | " "  | 0.0625 "                                                                                                                                                                                                                                                                                                          |   |    |       |       |
|       | Calc. for $\text{HgI}_2$ |      | Found                                                                                                                                                                                                                                                                                                             |   |    |       |       |
| I:    | 55.95                    |      | <table style="margin-left: auto; margin-right: auto; border-top: 1px solid black; border-bottom: 1px solid black;"> <tr> <td style="padding: 0 10px;">I</td> <td style="padding: 0 10px;">II</td> </tr> <tr> <td style="text-align: center;">56.27</td> <td style="text-align: center;">56.00</td> </tr> </table> | I | II | 56.27 | 56.00 |
| I     | II                       |      |                                                                                                                                                                                                                                                                                                                   |   |    |       |       |
| 56.27 | 56.00                    |      |                                                                                                                                                                                                                                                                                                                   |   |    |       |       |

Result of analyses of the dark brown, orange-yellow and yellow modifications of mercurous iodide.

|     |           |      |            |                |
|-----|-----------|------|------------|----------------|
| (1) | 0.4282 g. | gave | 0.3043 AgI | whence I=38.40 |
| (2) | 0.2204 "  | " "  | 0.1577 "   | "=38.67        |
| (3) | 0.2558 "  | " "  | 0.1834 "   | "=38.74        |
| (4) | 0.2038 "  | " "  | 0.1446 "   | "=38.34        |
| (5) | 0.0824 "  | " "  | 0.0587 "   | "=38.47        |

Theory for  $\text{HgI}$  requires I=38.84%, the Mercury amounted to 61.24%, that demanded by theory being 61.16%.

It will much facilitate operation if between 0·2 to 0·15 g. be taken for purposes of analyses. In the case of the dark brown variety of the haloid it is advisable to examine it carefully with a magnifying glass as inside its thick crust minute globules of mercury are often found enclosed.

From the foregoing inquiry it is evident that when the residue in the flask after the interaction of mercurous nitrite and ethyl iodide is heated in a tube between 190°–210°, mercurous iodide sublimes off. The compact mass of crystalline tablets thus obtained varies in all gradations of tint from lemon-yellow and orange-yellow to orange-brown and even dark brown.

*Chemical Laboratory, Presidency College.*

XIX.—*Description of a new Himalayan genus of Orobanchaceæ.*—

By J. S. GAMBLE, M.A., F.R.S., and D. PRAIN.

[Received 7th August; Read 5th October, 1900.]

GLEADOVIA Gamble & Prain.

*Calyx* tubulosus, parum inflatus limbo æqualiter 5-lobo. *Corollæ* tubus parum incurvus, labium posticum incurvo-erectum concavum minopere emarginatum, anticum brevius suberectum lobis 3 subæqualibus erectis. *Stamina* inclusa filamentis apice in connectivum conicum dilatatis, antherarum loculi æquales adnati basi divergentes et mucronato-  
aristati. *Ovarii* placentæ 4, per paria approximata, medioque confluentes; stigma dilatatum late æqualiter 2-lobum.—*Herba* parasitica carnosa rhizomate incrassato, squamis ovatis suffulta. *Flores* densius paniculati, pedicellati, 2-bracteolati. *Color* pallide purpurea.—*Species* singula, Himalaica.

The interesting plant for which we propose the above generic description was discovered in Jaunsar in 1898 by the officers of the Imperial Forest School, Dehra Dun; we dedicate it to Mr. F. Gleadow, who was the first actually to find it.

Our plant has all the facies of a *Christisonia*, but cannot be referred to that genus because both anther-cells are perfect, because the corolla is very markedly 2-labiate in place of being sub-equally 5-lobed, and because the two stigmatic lobes are equally large.

The nearest ally of our plant seems to be the American genus *Conopholis* Wallr., with which it agrees as regards corolla and, except that they are not exserted, as regards stamens, but from which it differs in having an equally 5-lobed calyx and a 2-lobed stigma. From

*Boschniackia* C. A. Mey., it differs somewhat as regards corolla and very greatly as regards stamens. From *Xylanche* Beck, (*Boschniackia himalaica* H. f. & T.) it further differs in having 2 carpels, not 3. From all the genera mentioned it differs markedly as regards inflorescence, which in those is spicate, in our plant paniculate.

*GLEADOVIA RUBORUM* Gamble & Prain.—A fleshy herb about 6 in. high of which only about one half epigaeal; *root-stock* very thick especially where attached to the host; *scales* ovate, the lower rounded, the upper acute sometimes 2-fid. *Flowers* paniculate; bract solitary, .7 in. long, sheathing, rounded, pedicel stout .35 in. long, bracteoles 2, .7—1 in long, spatulate, acute, concave. *Calyx* light-red, tubular, somewhat inflated, regularly 5-lobed, 1—1.2 in. long, lobes pale. *Corolla* red with darker veins, tube as long as calyx, slightly curved, distinctly two-lipped; upper lip of 2 connate lobes, rounded, slightly dentate, lower of 3 narrow, spatulate, subequal, acutely dentate lobes. *Stamens* 4, geniculate at point of insertion, anthers elongate, spurred, connective produced in a 2-fid cone, hairy above. *Ovary* 1-celled, ovate-cylindric; style long, incurved at apex; stigma of 2 broad semi-orbicular lobes depressed in the centre; placentæ 2 pairs, free below and above, confluent in the middle, diffuse; ovules very many. *Seeds* very many, minute.

N. W. HIMALAYA:—Bodiyar Jaunsar, 8–9,000 ft. ; on the northern slopes in very shady woods of Fir and Deodar on roots of wild Raspberry (*Rubus niveus*); very scarce, *Gleadow! Gamble! Duthie! Duthie's Collectors!*



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